

Radio Test Report (BT-EDR)

Report No.: RJ180430E08F-2

Test Model: WB01

Received Date: May 13, 2020

Test Date: May 26, 2020

Issued Date: June 10, 2020

Applicant: Coretronic Corp.

Address: No. 11, Li Hsing Rd, Science-Based Industrial Park, Hsinchu, Taiwan.

Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Hsin Chu Laboratory

Lab Address: E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300,
Taiwan

Test Location: E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300,
Taiwan



This report is for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence, provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents. Unless specific mention, the uncertainty of measurement has been explicitly taken into account to declare the compliance or non-compliance to the specification. The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any government agencies.

Table of Contents

Release Control Record	3
1 Certificate of Conformity	4
2 Summary of Test Results	5
2.1 Test Instruments	6
2.2 Measurement Uncertainty	7
2.3 Modification Record	7
3 General Information	8
3.1 General Description of EUT	8
3.2 Description of Test Modes	9
3.3 Test Conditions	10
3.4 Assembly	10
3.5 Antenna Specifications	10
3.5.1 Antenna Gain	10
3.5.2 Antenna Pattern	10
4 Test Results	11
4.1 Frequency Tolerance Measurement	11
4.1.1 Limits of Frequency Tolerance Measurement	11
4.1.2 Test Setup	11
4.1.3 Test Results	11
4.2 Occupied Bandwidth Measurement (99% power bandwidth)	12
4.2.1 Limits of Occupied Bandwidth Measurement	12
4.2.2 Test Setup	12
4.2.3 Test Results	13
4.3 Spreading Bandwidth Measurement (90% power bandwidth)	19
4.3.1 Limits of Spreading Bandwidth and Spreading Factor Measurement	19
4.3.2 Test Setup	19
4.3.3 Test Results	20
4.4 Spurious Emissions for Transmitter Measurement	26
4.4.1 Limits of Spurious Emissions	26
4.4.2 Test Setup	26
4.4.3 Test Results	27
4.5 Antenna Power Measurement	39
4.5.1 Limits of Antenna Power	39
4.5.2 Test Setup	39
4.5.3 Test Results	40
4.6 Spurious Emissions for Receiver	42
4.6.1 Limits of Spurious Emissions for Receiver	42
4.6.2 Test Setup	42
4.6.3 Test Result	43
4.7 Dwell Time	47
4.7.1 Limits of Dwell Time	47
4.7.2 Test Setup	47
4.7.3 Test Result	48
4.8 Interference Prevention Function	90
4.8.1 Limits of Interference Prevention Function	90
4.8.2 Test Setup	90
4.8.3 Test Results	90
5 Photographs of the Test Configuration	91
Appendix - Information of the Testing Laboratories	92

Release Control Record

Issue No.	Description	Date Issued
RJ180430E08F-2	Original release.	June 10, 2020

1 Certificate of Conformity

Product: WiFi 11a/b/g/n/ac 2T2R and BT4.0 Module

Brand: Coretronic

Test Model: WB01

Sample Status: ENGINEERING SAMPLE

Applicant: Coretronic Corp.

Test Date: May 26, 2020

Standards: ARIB STD-T66 (V3.7), MIC notice 88 Appendix 43
Certification Ordinance Article 2-1-19

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 EMC characteristics under the conditions specified in this report.

Prepared by : Vivian Huang , **Date:** June 10, 2020
Vivian Huang / Specialist

Approved by : Clark Lin , **Date:** June 10, 2020
Clark Lin / Technical Manager

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				
--	--	3.5	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)	C
--	3.4.1(1)	4.8	Interference Prevention Function	C
--	3.4.1(3)	--	Carrier Sense Capability	NA
Note: 1. C = Conform NC = Not Conform NT = Not Tested NA = Not Applicable 2. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.				

2.1 Test Instruments

Description & Manufacturer	Model no.	Serial No.	Calibrated Date	Calibrated Until	Calibration Authority
Spectrum Analyzer R&S	FSV40	100964	June 04, 2019	June 03, 2020	ETC
ESG Vector signal generator Agilent	E4438C	MY45094468	Nov. 14, 2019	Nov. 13, 2020	ETC
Detector Narda	4503A	0306	NA	NA	NA
Power Meter Anritsu	ML2495A	1529002	July 26, 2019	July 25, 2020	ETC
Power Sensor Anritsu	MA2411B	1339443	July 26, 2019	July 25, 2020	ETC
Digital Oscilloscope R&S	RTO1012	300053	June 25, 2019	June 24, 2020	ETC
DC Power Supply Topward	6603D	795558	NA	NA	NA
AC Power Source Extech Electronics	6205	1440452	NA	NA	NA
True RMS Clamp Meter FLUKE	179	89610322	Sep. 25, 2019	Sep. 24, 2020	ETC

NOTE:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. Tested Date: May 26, 2020

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	703.56 Hz
Spurious emissions	2.52 dB
Output power density	1.37 dB
Out of band radiated power	2.52 dB
Frequency Tolerance	703.56 Hz

2.3 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	WiFi 11a/b/g/n/ac 2T2R and BT4.0 Module
Brand	Coretronic
Test Model	WB01
Status of EUT	ENGINEERING SAMPLE
Nominal Voltage	3.3Vdc from host equipment
Modulation Type	GFSK, $\pi/4$ -DQPSK, 8DPSK
Modulation Technology	FHSS
Transfer Rate	Up to 3Mbps
Operating Frequency	2402MHz ~ 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	Refer to section 3.5
Antenna Connector	Refer to section 3.5
Accessory Device	NA
Data Cable Supplied	NA

Note:

1. There are WLAN and Bluetooth technology used for the EUT.
2. Simultaneously transmission condition.

Condition	Technology	
1	WLAN (2.4GHz)	Bluetooth
2	WLAN (5GHz)	Bluetooth

3. The power table as below table:

	Rated output power density (mW/MHz)	Conducted RF output power density (mW/MHz)	Radiated RF output power density (mW/MHz)
Normal mode			
GFSK	0.1	0.08502	0.253233
$\pi/4$-DQPSK	0.1	0.048787	0.145313
8DPSK	0.1	0.048204	0.143576
Enable AFH function			
GFSK	0.4	0.334259	0.995596
$\pi/4$-DQPSK	0.4	0.189934	0.565722
8DPSK	0.4	0.18819	0.560527

4. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.

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: The channels which were indicated in bold type of the above channel list were selected as representative test channel. Therefore only the data of the test channels were recorded in this report.

By means of test software (WCN_Combo_Tool V1.13.23.0) provided by manufacturer, the power levels during the tests were set according to the following codes:

Modulation type: GFSK		Modulation type: $\pi/4$ -DQPSK		Modulation type: 8DPSK	
Channel	Power setting	Channel	Power setting	Channel	Power setting
0	7	0	7	0	7
39	7	39	7	39	7
78	7	78	7	78	7

NOTE 2: The EUT was tested under following test modes, and the test data was recorded in this report:

Normal mode	Enable AFH function
GFSK	GFSK
$\pi/4$ -DQPSK	$\pi/4$ -DQPSK
8DPSK	8DPSK

* For AFH function only tested occupied bandwidth, spreading bandwidth, Antenna power and dwell time.

3.3 Test Conditions

Test Conditions		Voltage (Vdc)
V_{normal}		3.3
$V_{max.}$	+10%	3.63
$V_{min.}$	-10%	2.97

3.4 Assembly

The EUT is constructed as a WiFi 11a/b/g/n/ac 2T2R and BT4.0 Module. The RF circuit was covered by metal shielding case, and the metal shielding case was soldered on PCB.

3.5 Antenna Specifications

3.5.1 Antenna Gain

Ant No.	Brand	Model	Antenna Gain (dBi)	Frequency range (GHz)	Antenna type	Connector Type	Cable Length
WiFi 1	HSIEN JINN INDUSTRY Co., Ltd.	42.002DFG001	4.89	2.4~2.4835	PCB	MHF1	550mm
			4.16	4.90~5.90			
WiFi 2	HSIEN JINN INDUSTRY Co., Ltd.	42.002DFG001	4.89	2.4~2.4835	PCB	MHF1	550mm
			4.16	4.90~5.90			
BT	HSIEN JINN INDUSTRY Co., Ltd.	42.002DFG002	4.74	2.4~2.4835	PCB	MHF1	480mm

3.5.2 Antenna Pattern

Please refer to the attached file (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, 60% RH					
Channel	Frequency (MHz)	Voltage _{normal}		Voltage _{max.}		Voltage _{min.}	
		Carrier frequency (MHz)	Frequency tolerance (ppm)	Carrier frequency (MHz)	Frequency tolerance (ppm)	Carrier frequency (MHz)	Frequency tolerance (ppm)
0	2402	2401.989473	-4.382	2401.989444	-4.394	2401.989473	-4.382
39	2441	2440.989323	-4.374	2440.989323	-4.374	2440.989294	-4.385
78	2480	2479.989119	-4.387	2479.989148	-4.375	2479.989148	-4.375

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

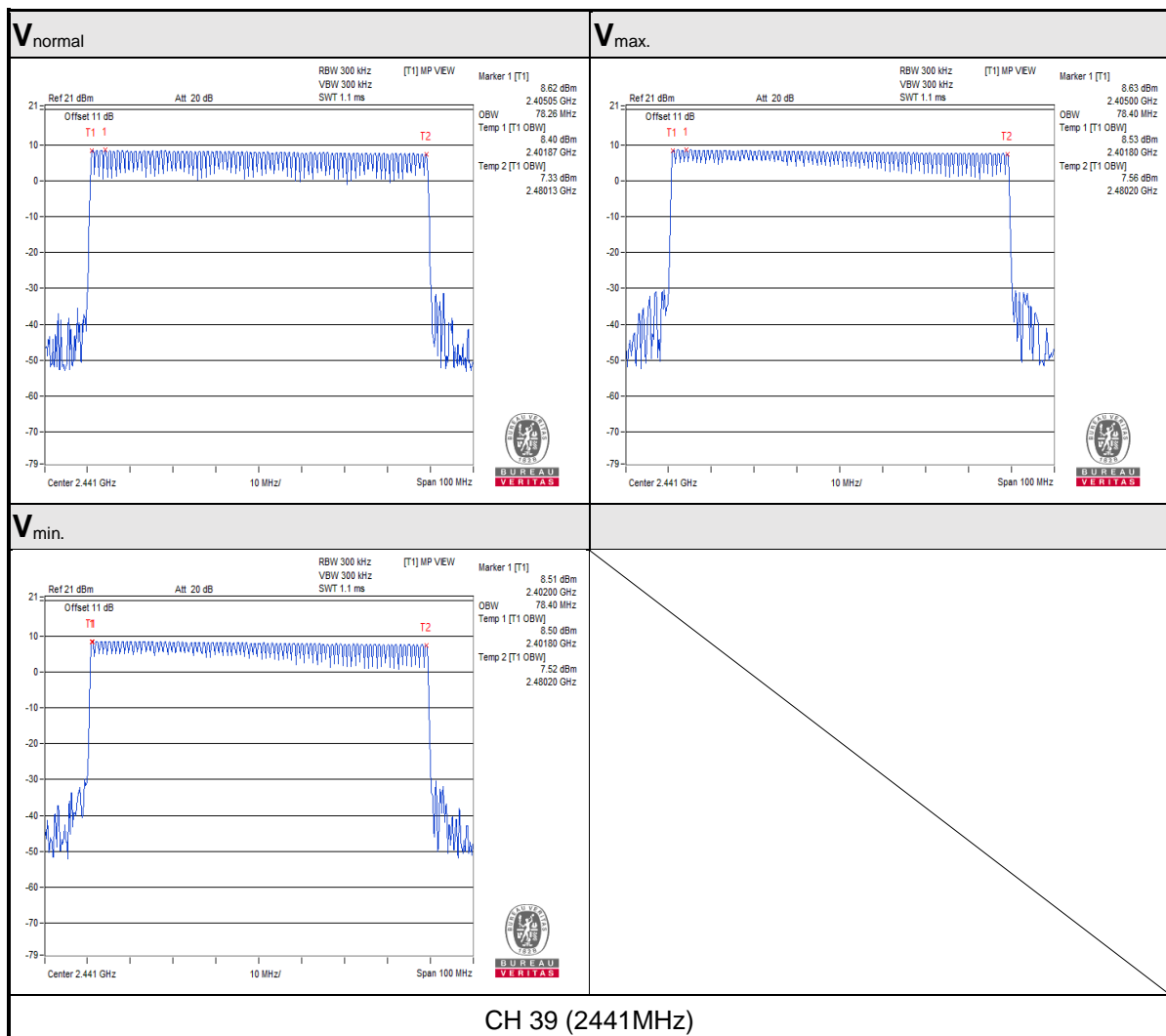


4.2.3 Test Results

Modulation: GFSK

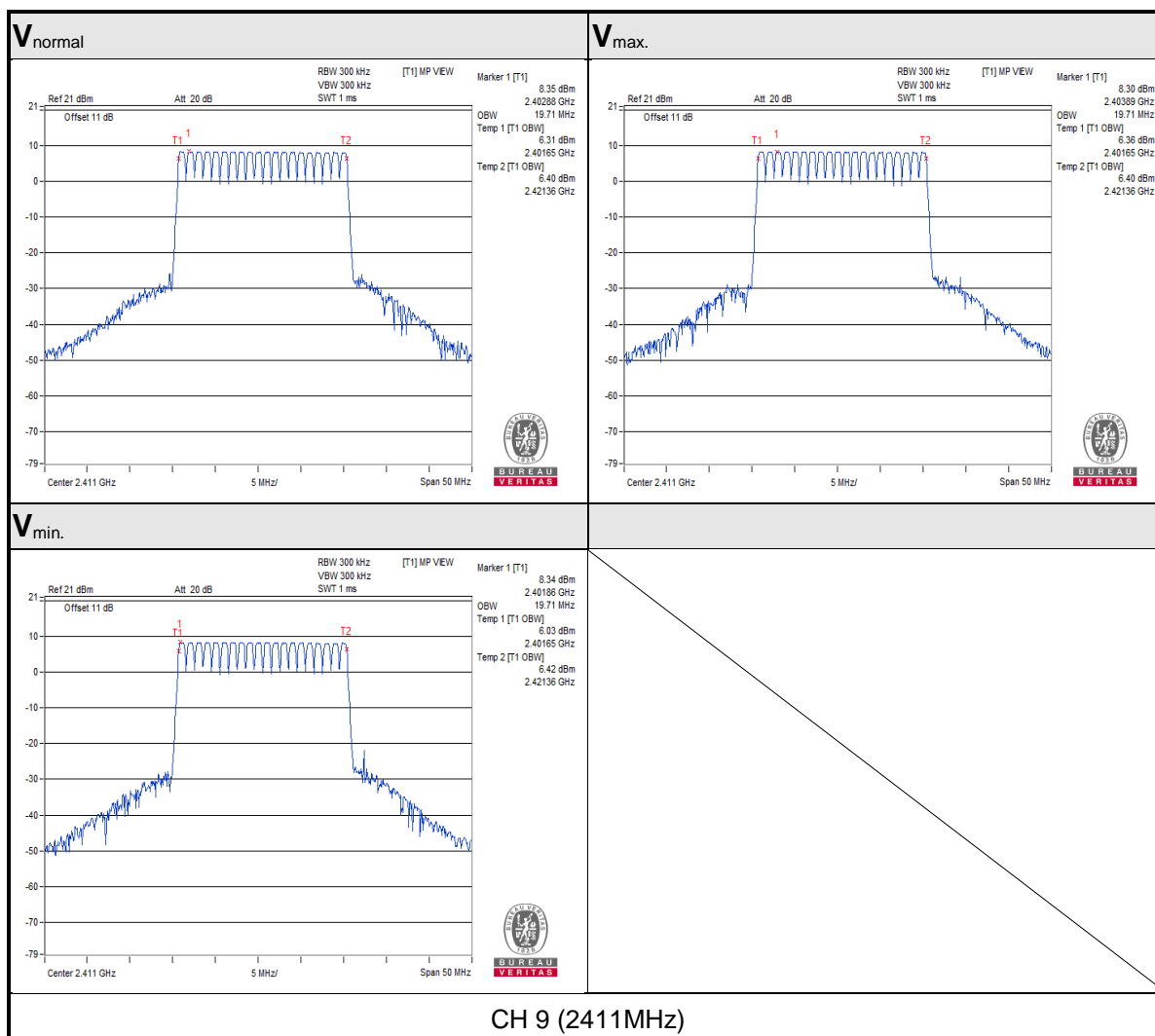
Normal Mode:

Environmental Conditions	25 deg.C, 60% RH	
V_{normal}	$V_{max.}$	$V_{min.}$
Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)
78.26	78.40	78.40



AFH Mode:

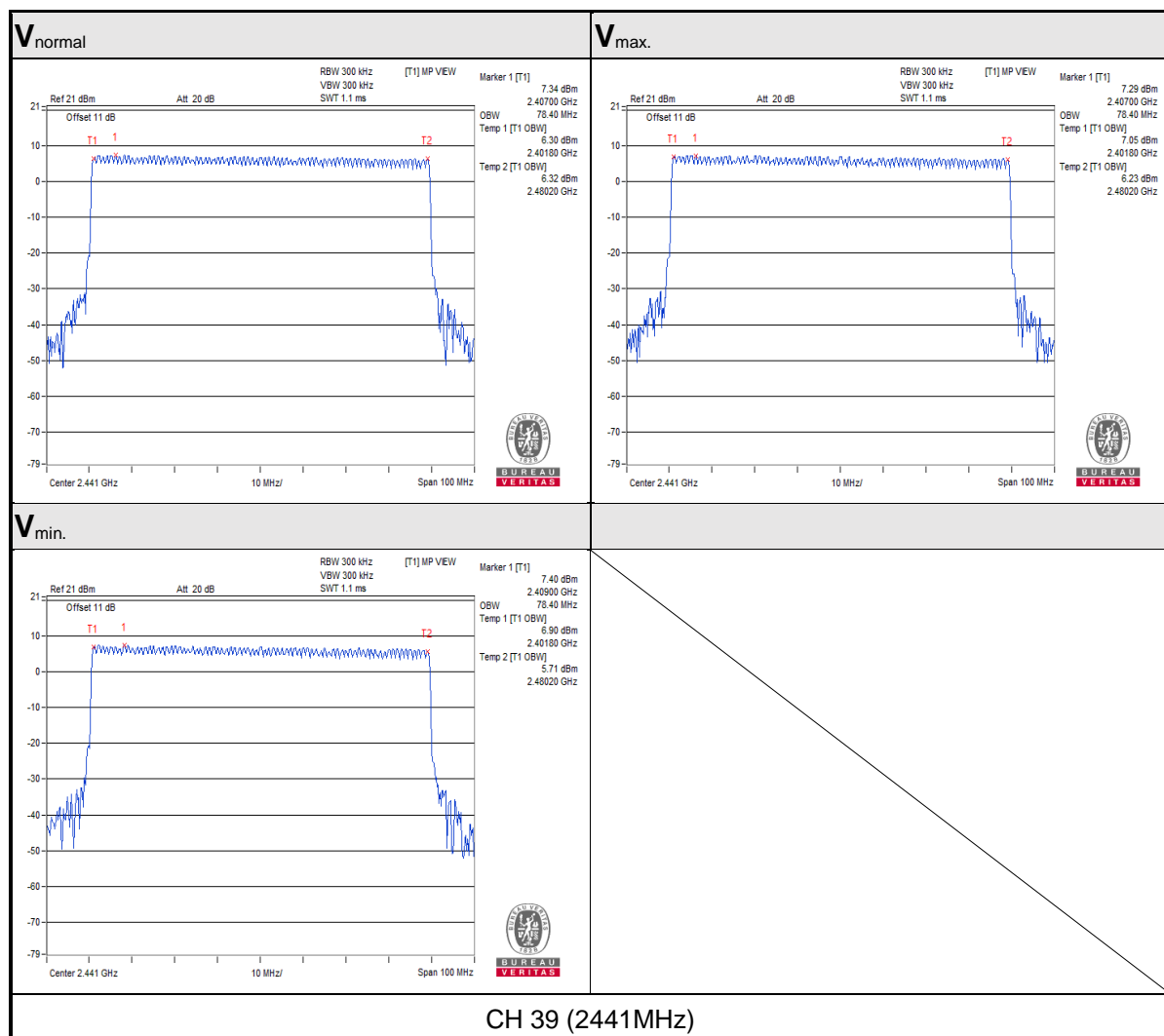
Environmental Conditions	25 deg.C, 60% RH	
V _{normal}	V _{max.}	V _{min.}
Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)
19.71	19.71	19.71



Modulation: $\pi/4$ -DQPSK

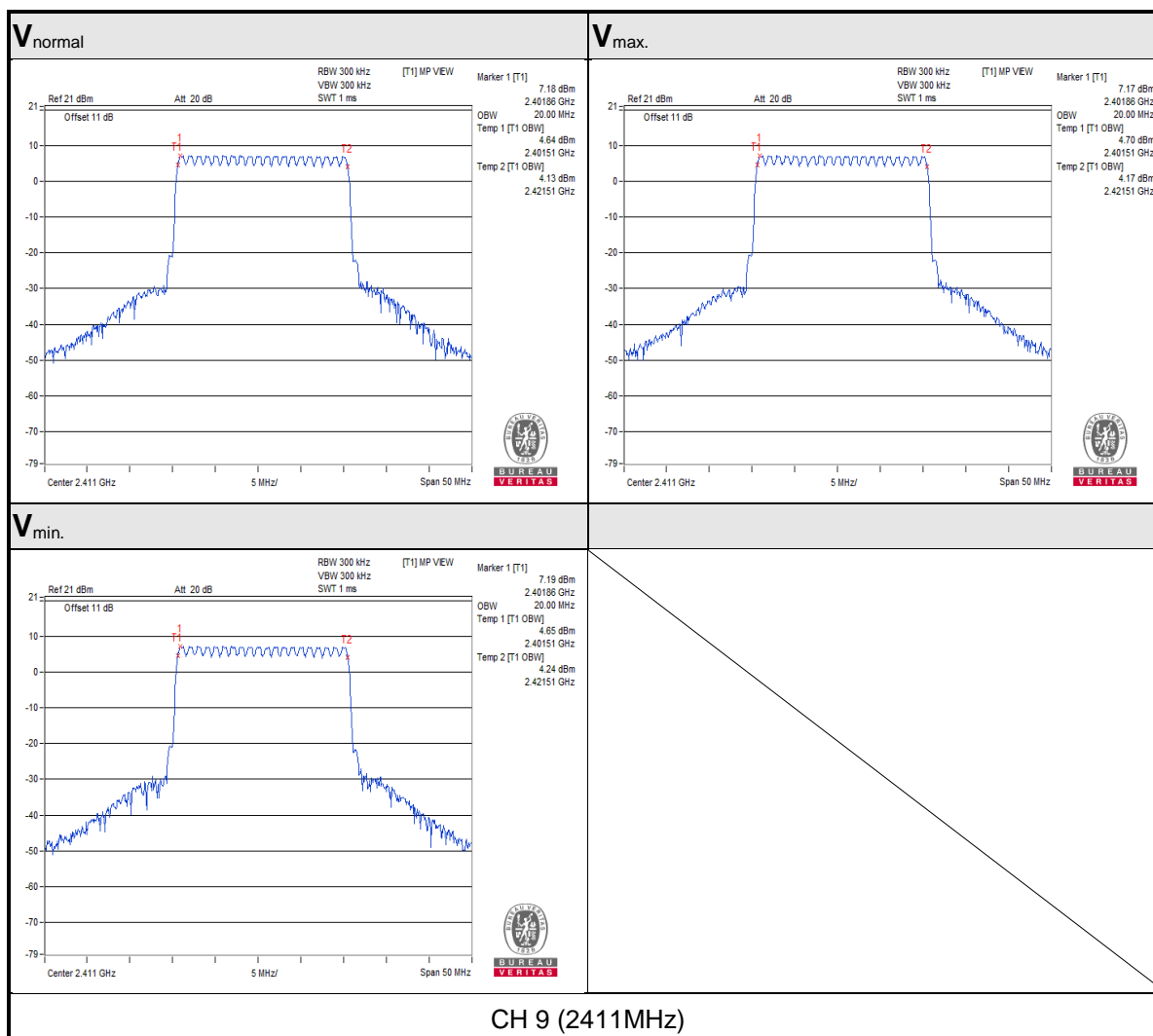
Normal Mode:

Environmental Conditions	25 deg.C, 60% RH	
V_{normal}	$V_{max.}$	$V_{min.}$
Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)
78.40	78.40	78.40



AFH Mode:

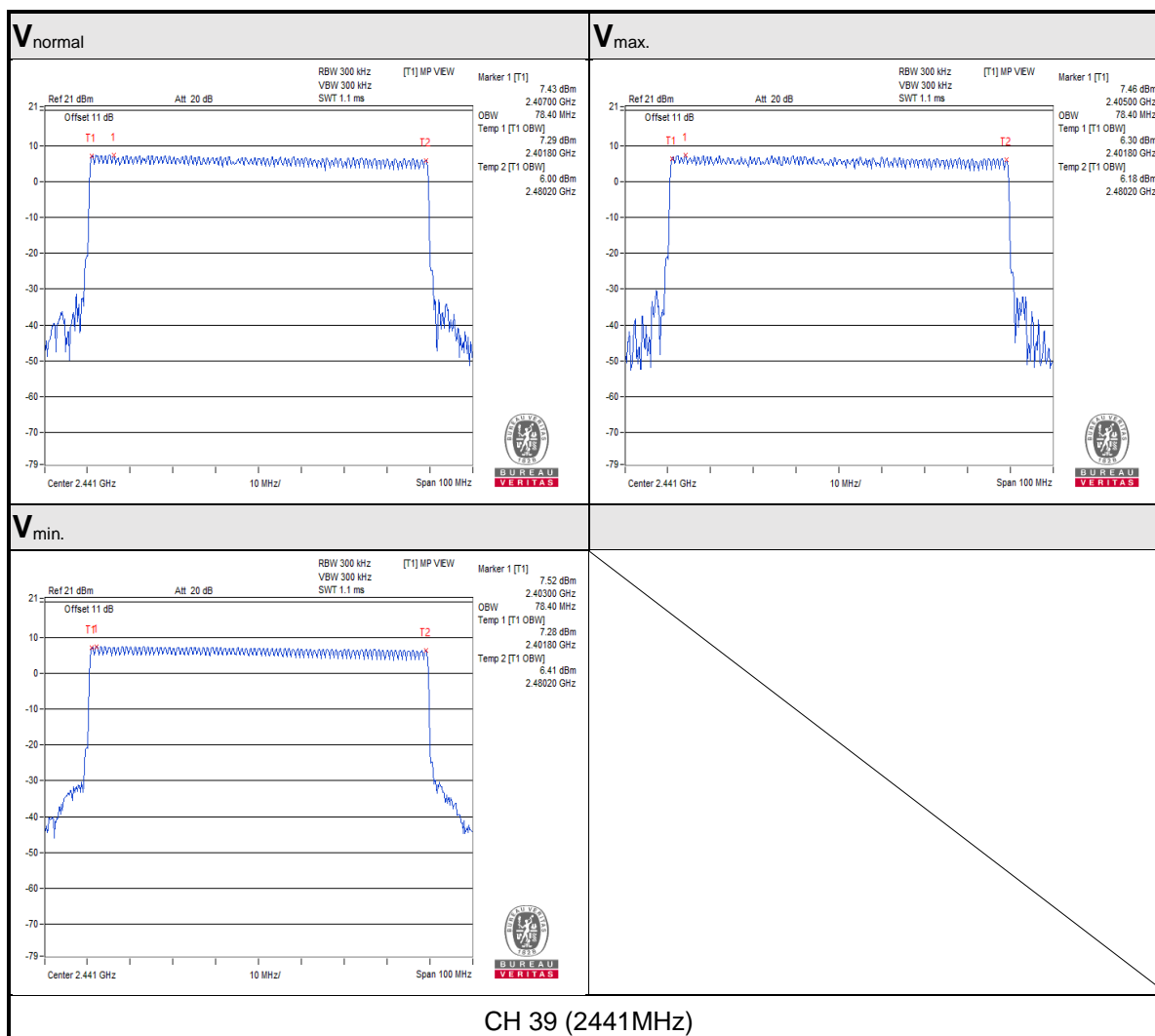
Environmental Conditions	25 deg.C, 60% RH	
V _{normal}	V _{max.}	V _{min.}
Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)
20.00	20.00	20.00



Modulation: 8DPSK

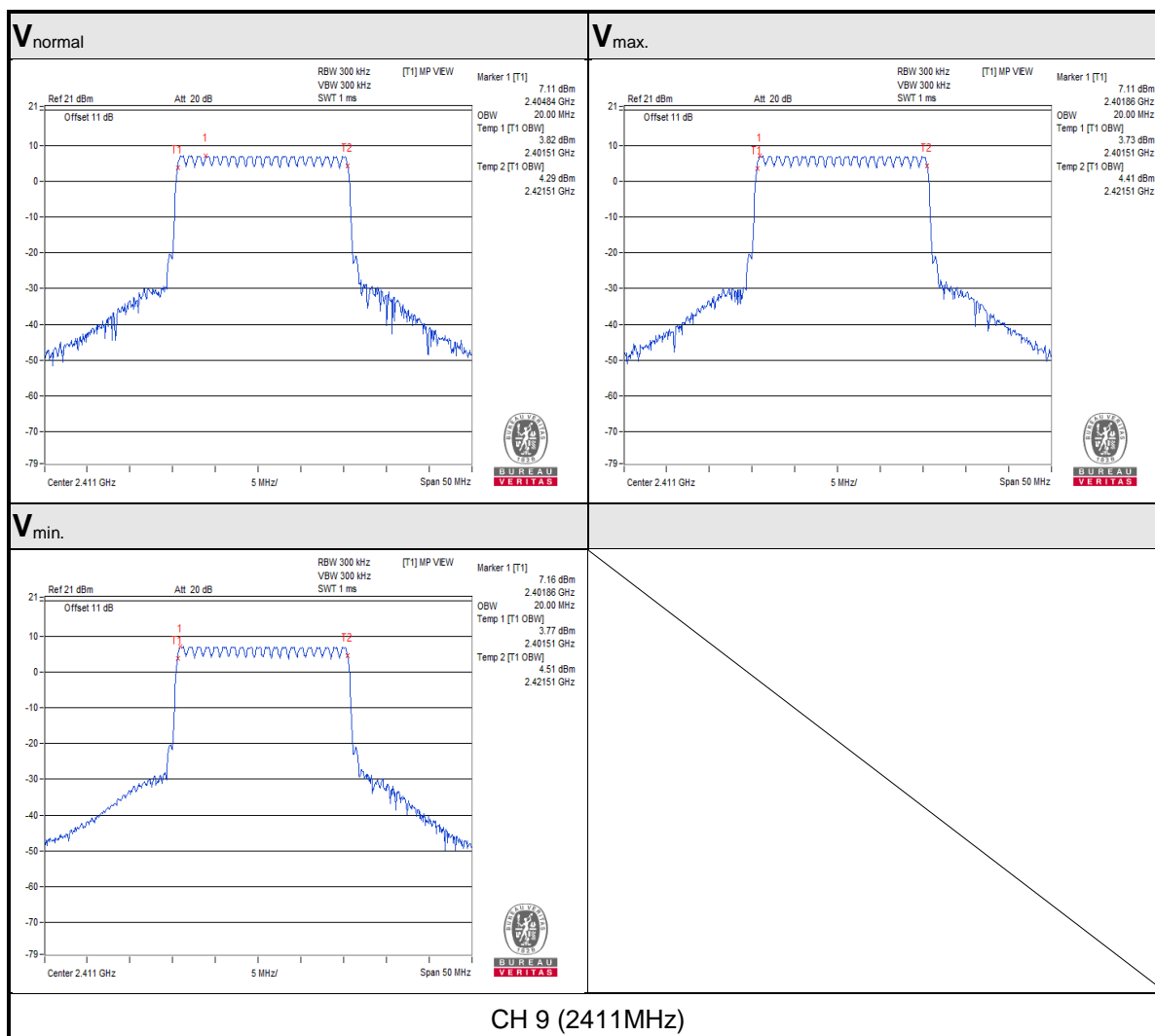
Normal Mode:

Environmental Conditions	25 deg.C, 60% RH	
V _{normal}	V _{max.}	V _{min.}
Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)
78.40	78.40	78.40



AFH Mode:

Environmental Conditions	25 deg.C, 60% RH	
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 Limits of Spreading Bandwidth and Spreading Factor Measurement

Item	Limit	Remark
Spreading Bandwidth	$\geq 500\text{kHz}$	(For DSSS, FHSS)
Spreading Factor	≥ 5	Operating frequency 2400 to 2483.5MHz

4.3.2 Test Setup



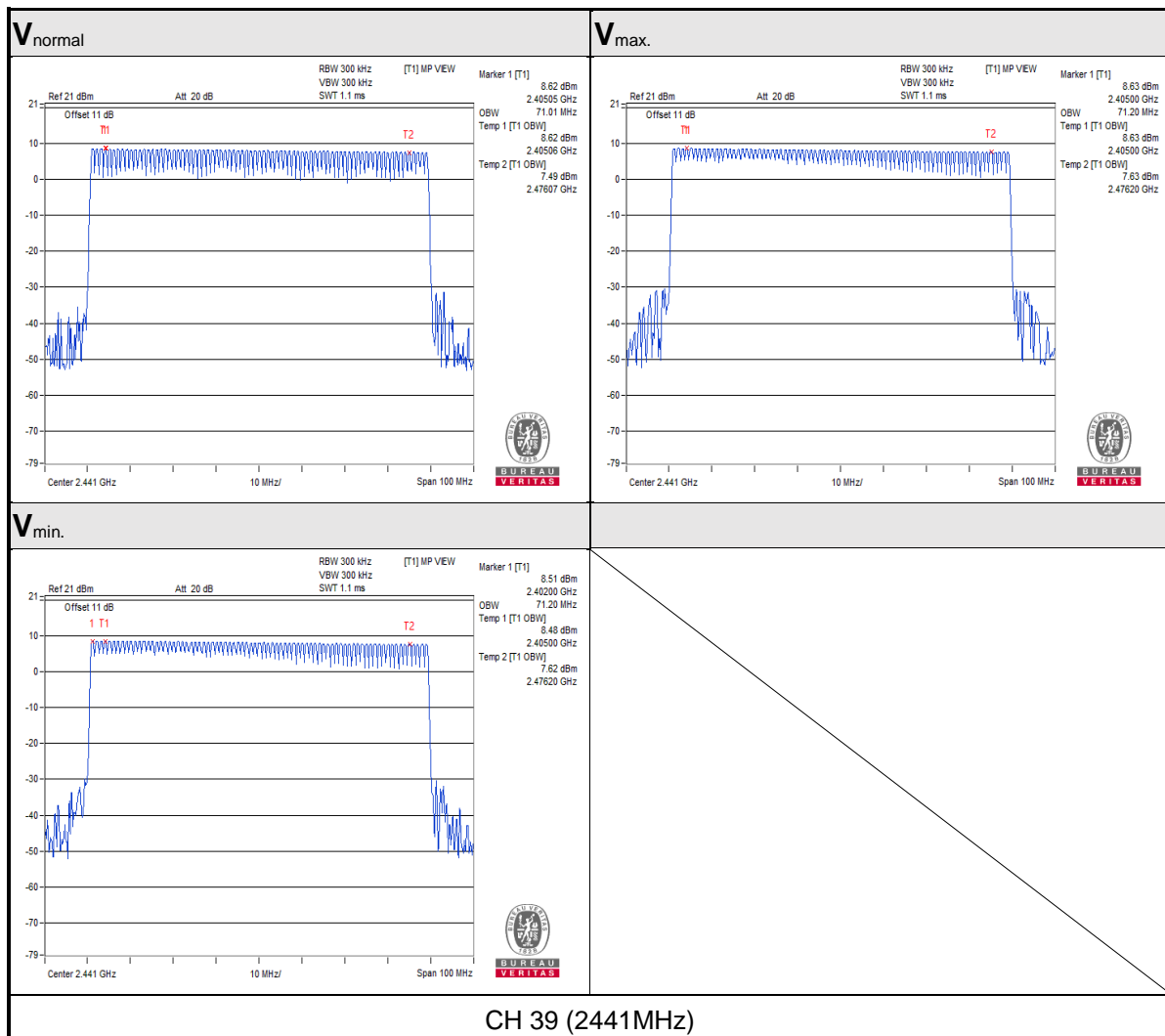
4.3.3 Test Results

Modulation: GFSK

Normal Mode:

Environmental Conditions		25 deg.C, 60% RH			
V _{normal}		V _{max.}		V _{min.}	
Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor
71.01	71.01	71.20	71.20	71.20	71.20

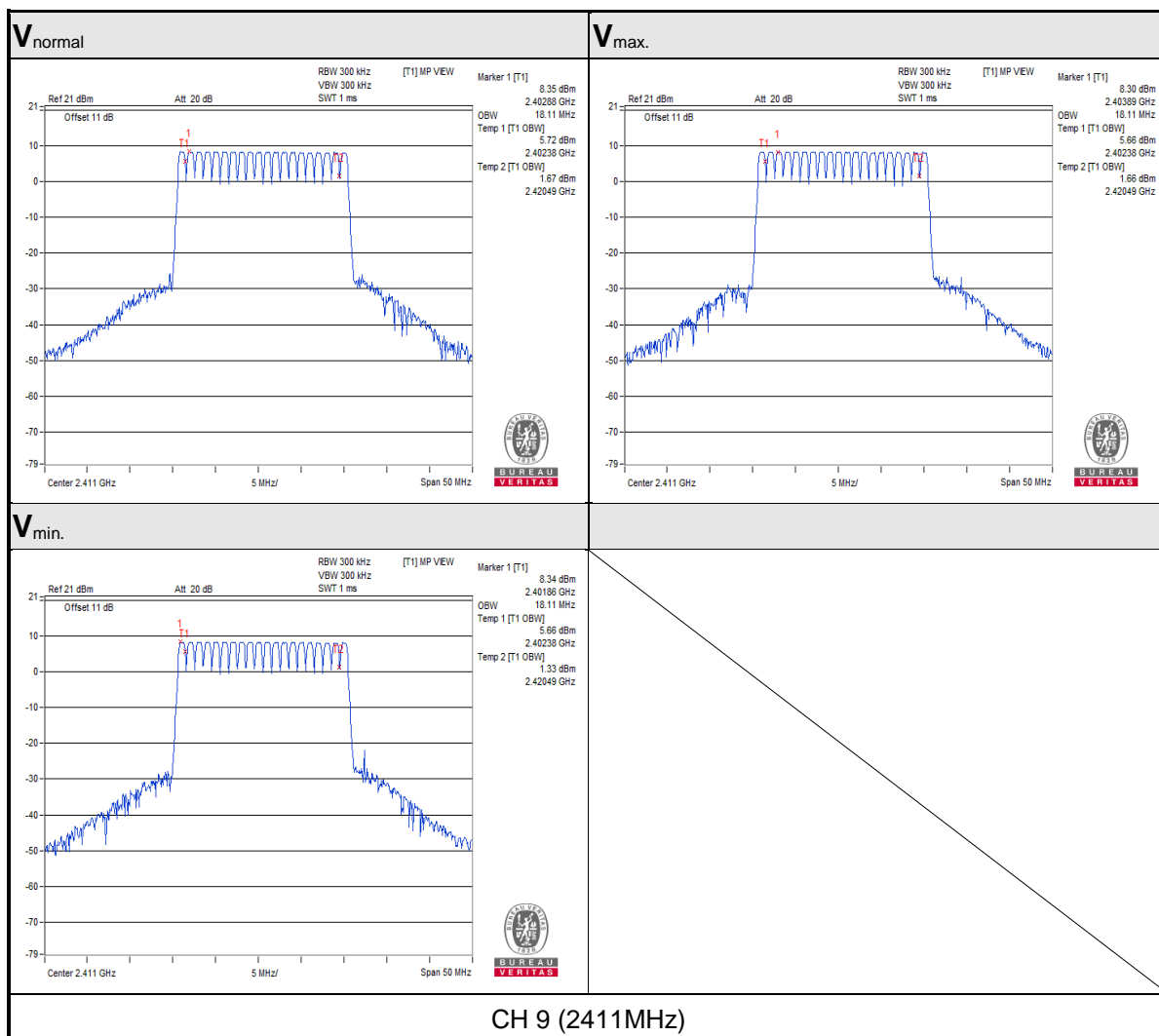
Note: 1. Spreading Factor: 90% channel power bandwidth / 1.



AFH Mode:

Environmental Conditions		25 deg.C, 60% RH			
V _{normal}		V _{max.}		V _{min.}	
Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor
18.11	18.11	18.11	18.11	18.11	18.11

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

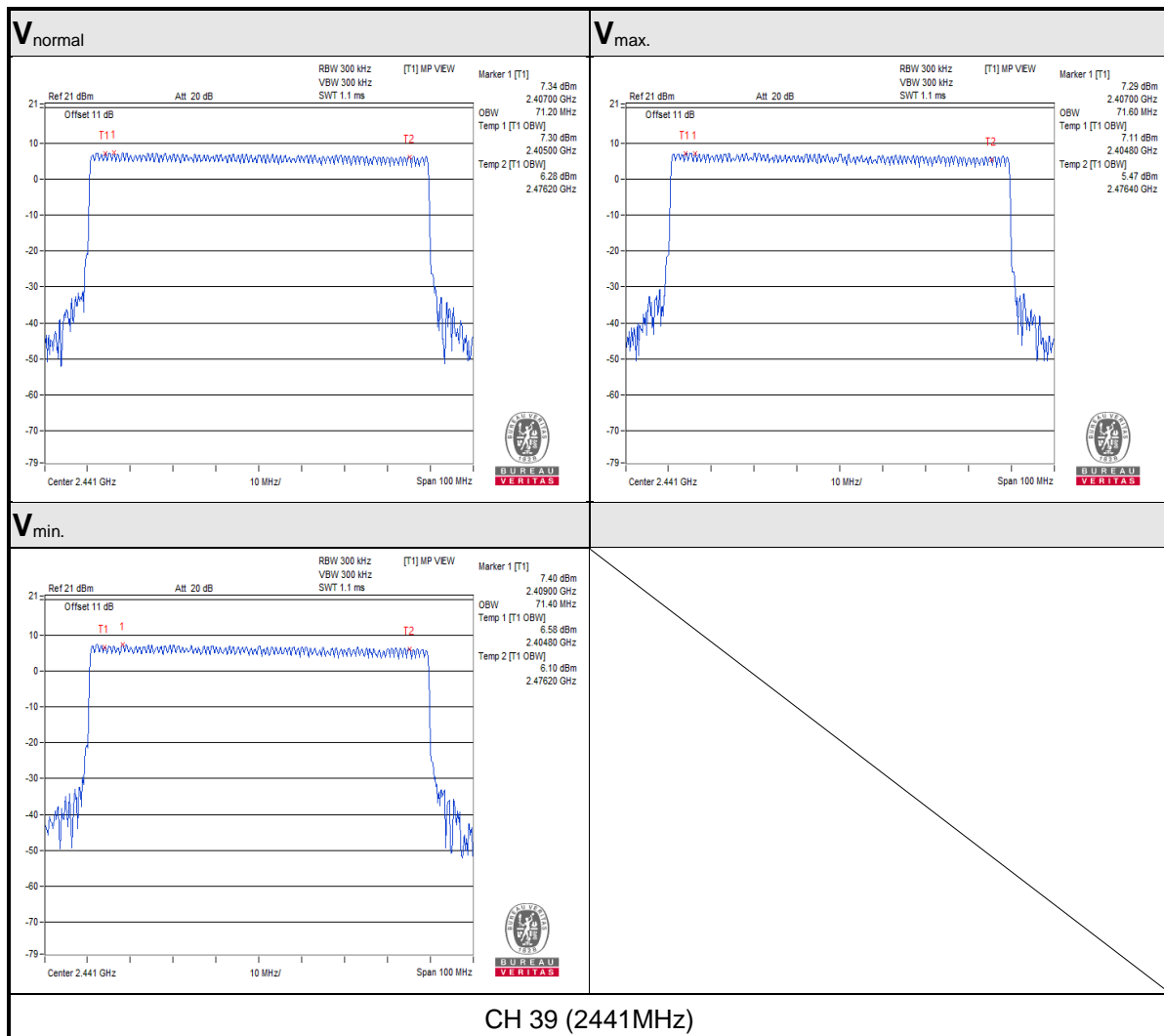


Modulation: $\pi/4$ -DQPSK

Normal Mode:

Environmental Conditions		25 deg.C, 60% RH			
V_{normal}		$V_{max.}$		$V_{min.}$	
Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor
71.20	71.20	71.60	71.60	71.40	71.40

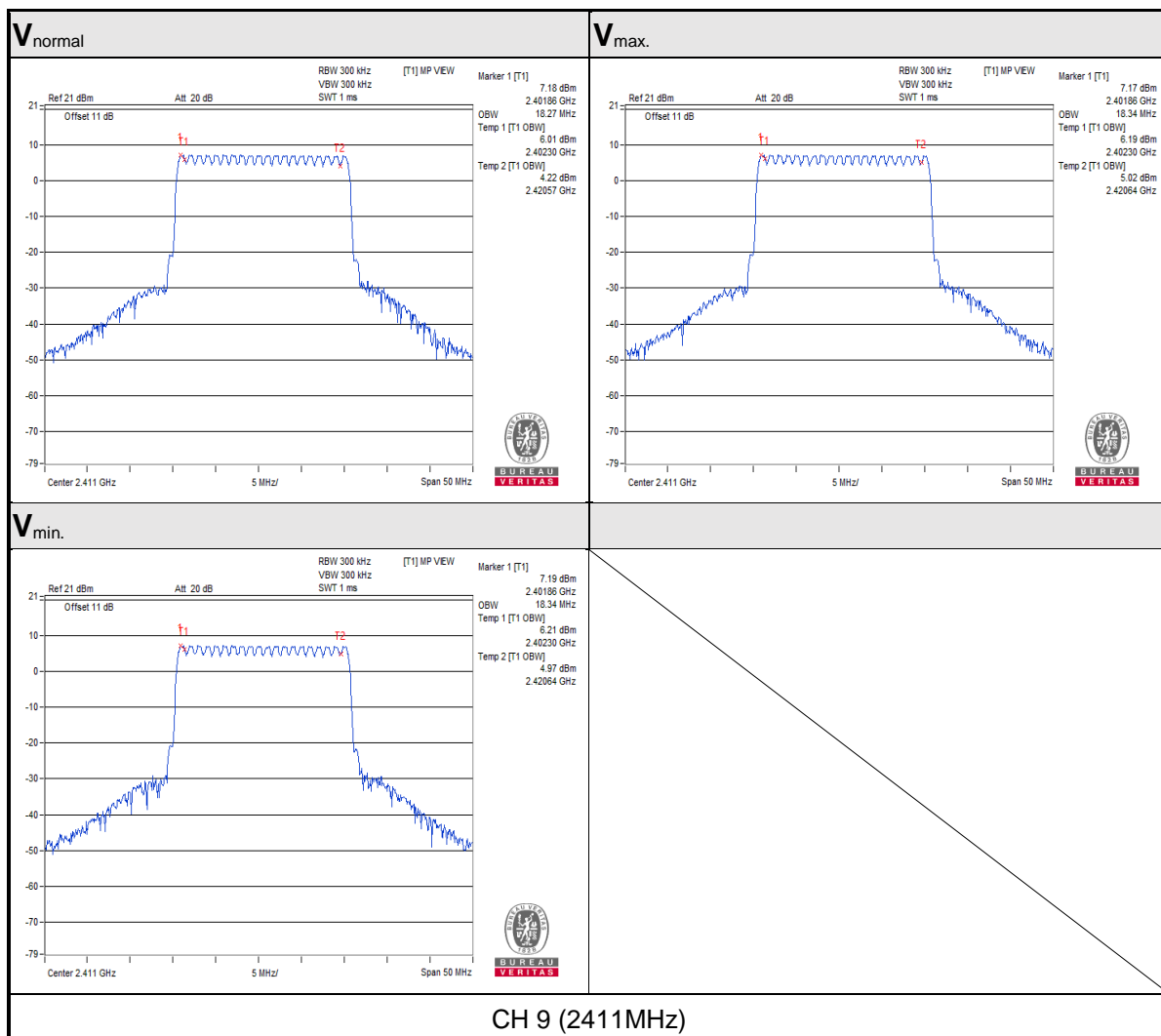
Note: 1. Spreading Factor: 90% channel power bandwidth / 1.



AFH Mode:

Environmental Conditions		25 deg.C, 60% RH			
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	18.34	18.34	18.34	18.34

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

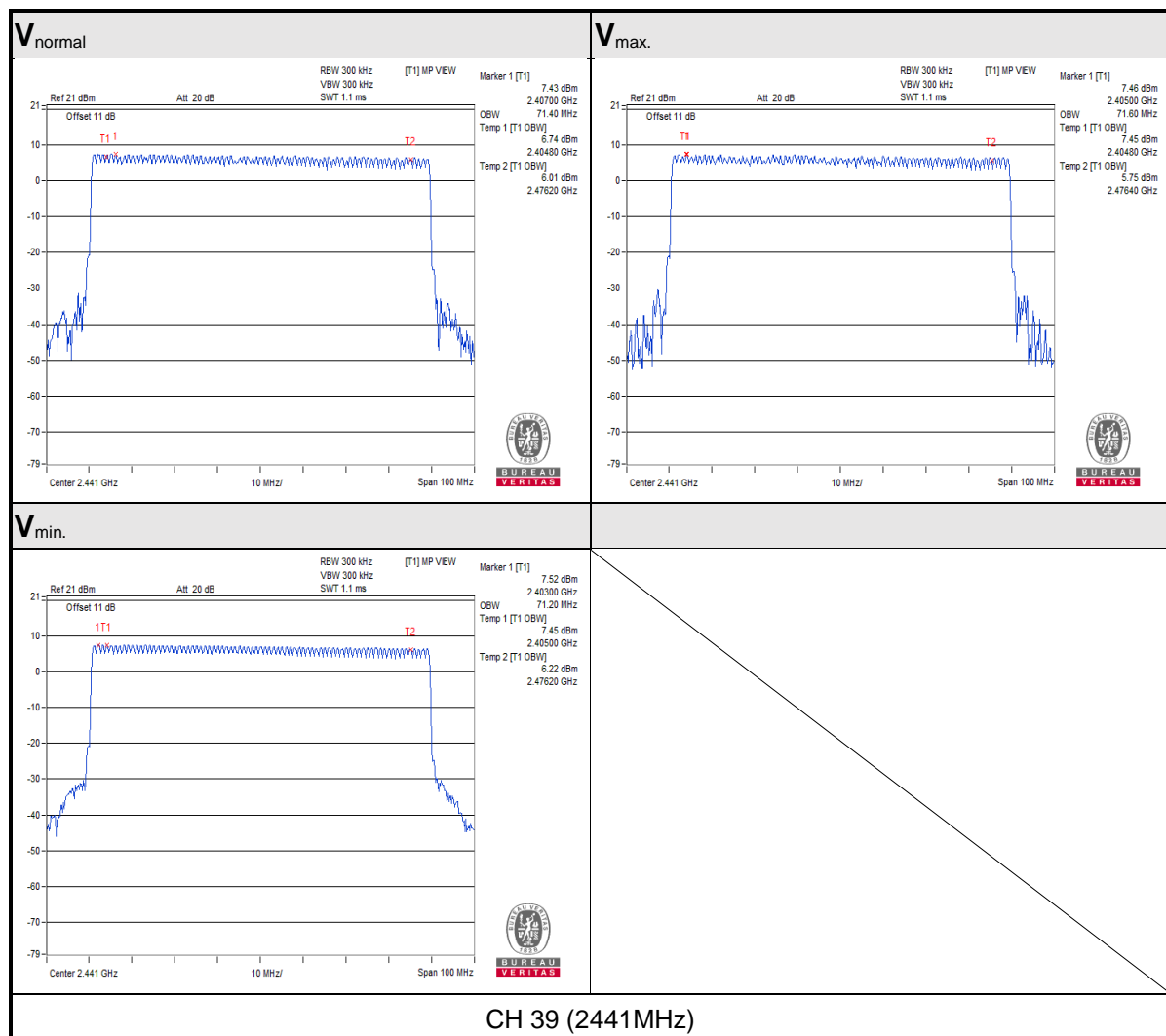


Modulation: 8DPSK

Normal Mode:

Environmental Conditions		25 deg.C, 60% RH			
V _{normal}		V _{max.}		V _{min.}	
Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor
71.40	71.40	71.60	71.60	71.20	71.20

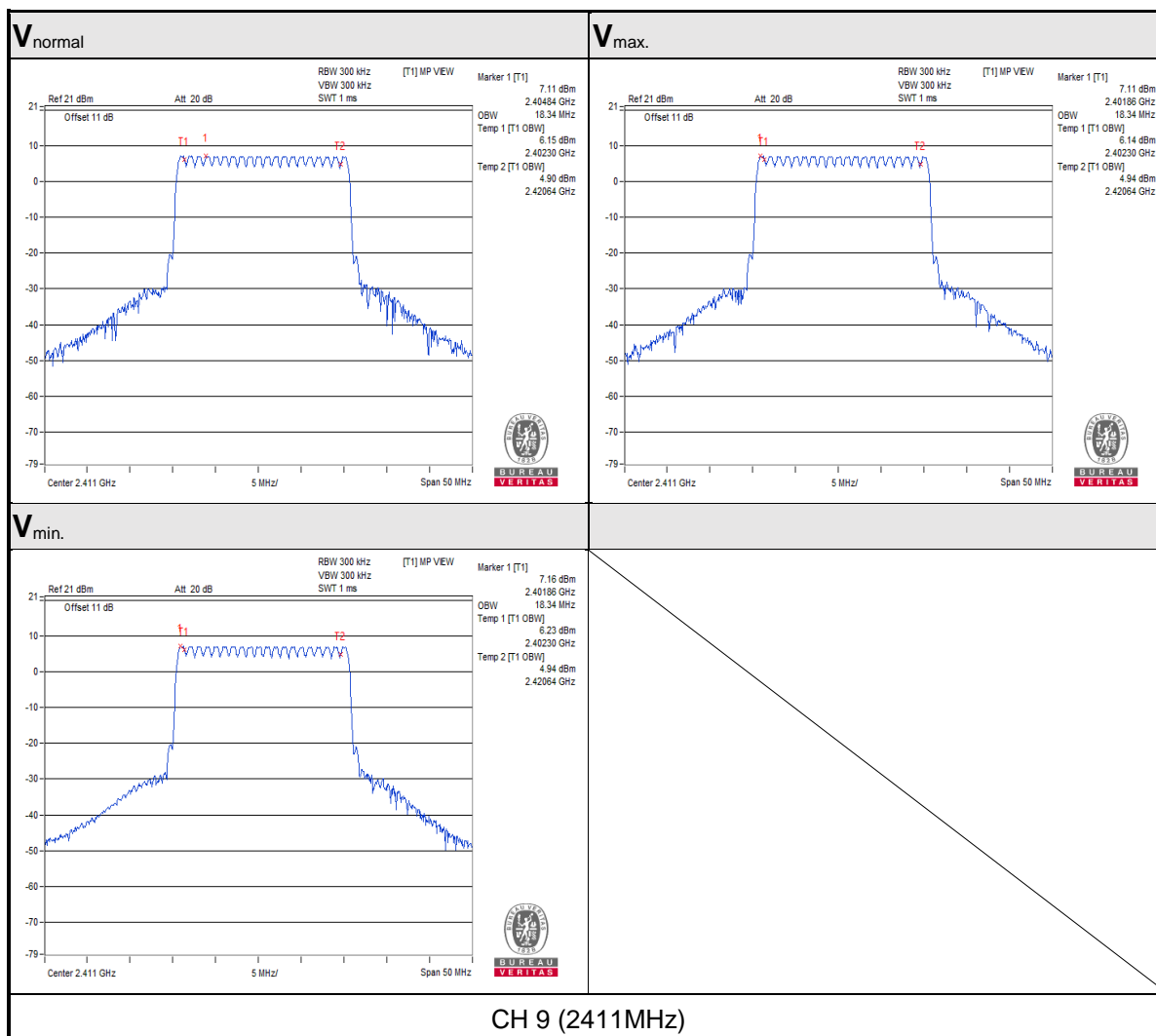
Note: 1. Spreading Factor: 90% channel power bandwidth / 1.



AFH Mode:

Environmental Conditions		25 deg.C, 60% RH			
V _{normal}		V _{max.}		V _{min.}	
Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor
18.34	18.34	18.34	18.34	18.34	18.34

Note: 1. 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	$\leq 0.25 \text{ uW/100kHz}$
1000.0MHz to 2387MHz	$\leq 2.5 \text{ uW/MHz}$
2387.0MHz to 2400.0MHz	$\leq 25 \text{ uW/MHz}$
2483.5MHz to 2496.5MHz	$\leq 25 \text{ uW/MHz}$
2496.5MHz to 12500.0MHz	$\leq 2.5 \text{ uW/MHz}$

4.4.2 Test Setup

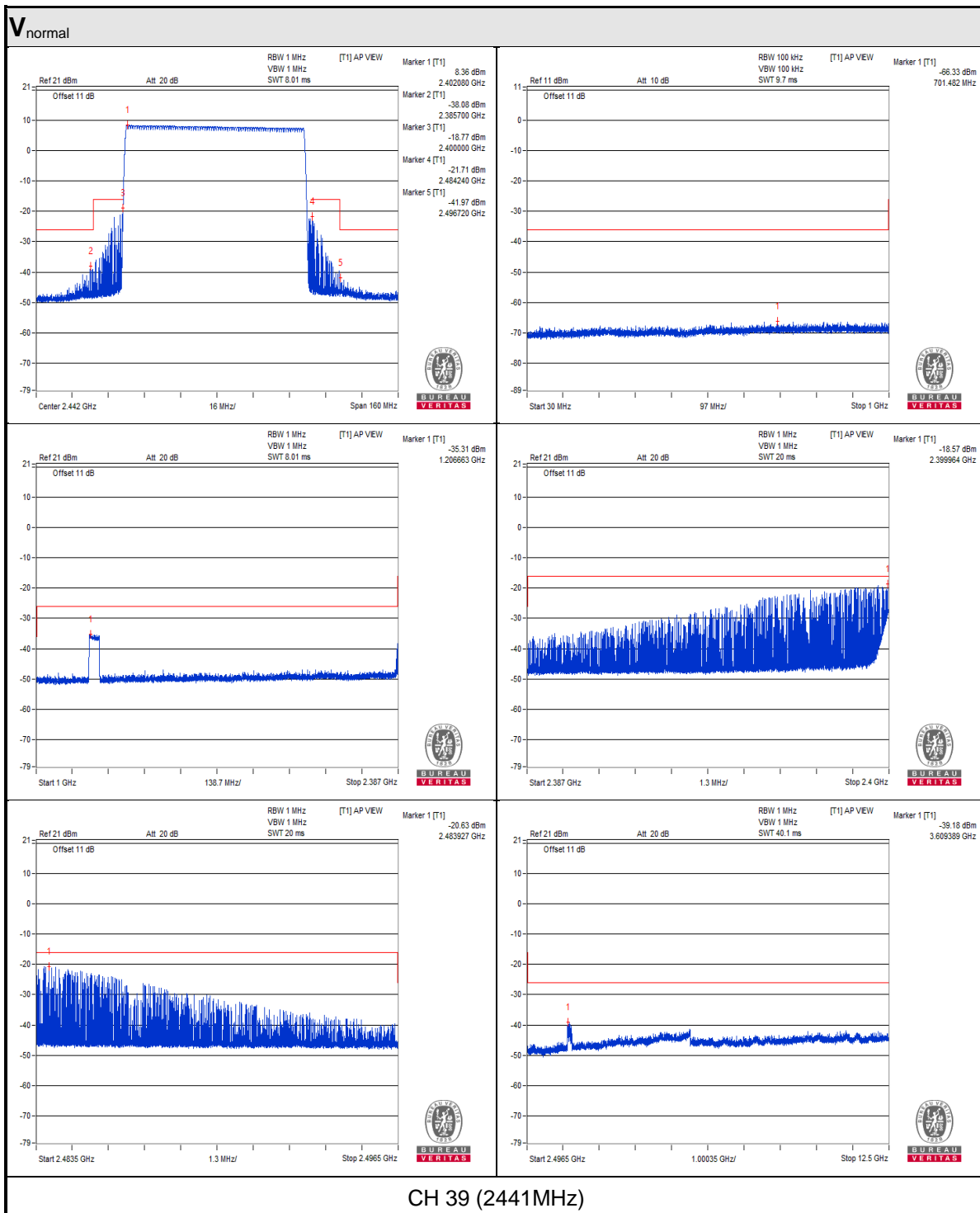


4.4.3 Test Results

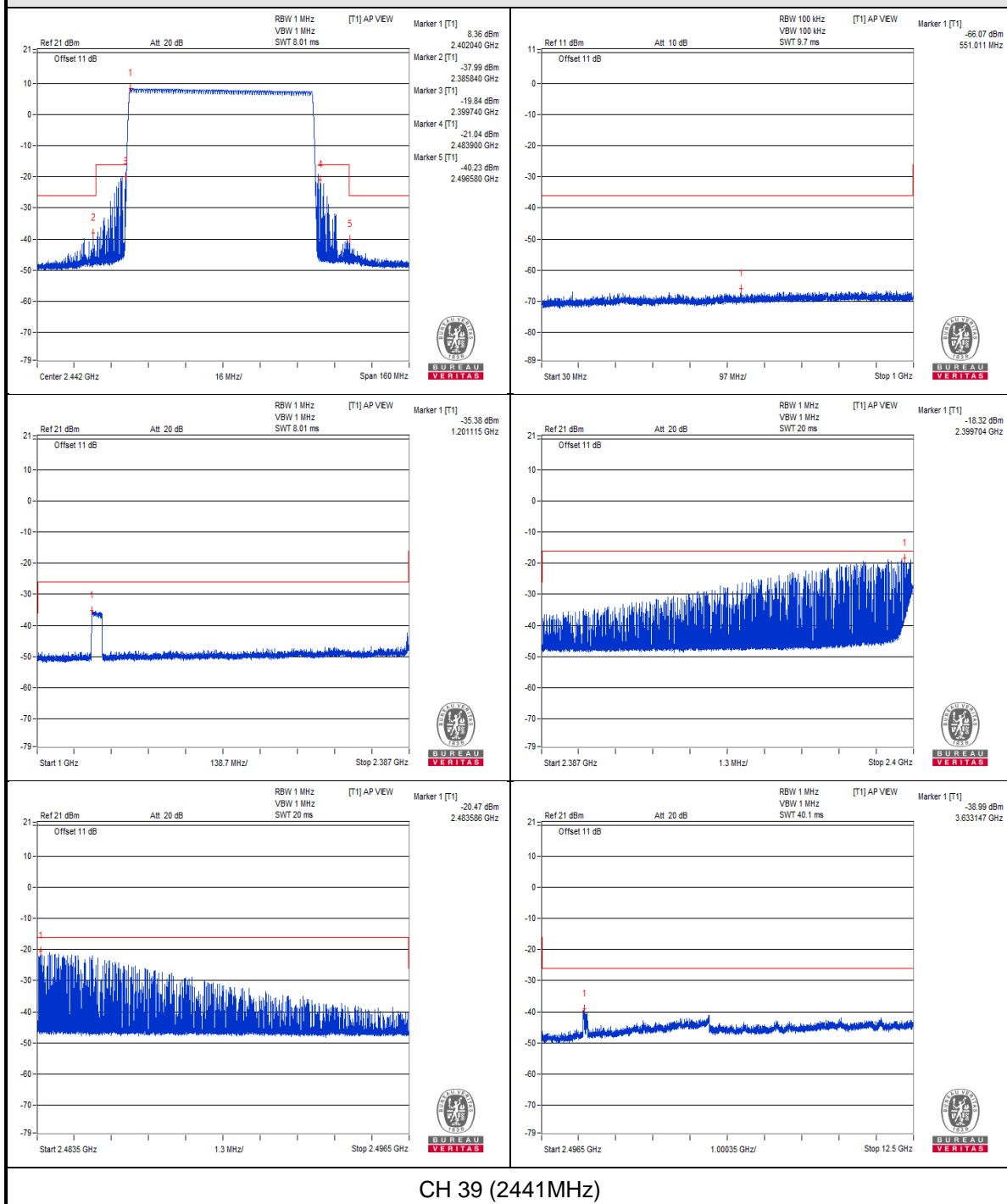
Modulation: GFSK

TEST CHANNEL		CH 39 (2441MHz)			
TEST CONDITION	FREQUENCY RANGE(MHz)	FREQUENCY (MHz)	MEASURE. VALUE(uW)	LIMIT (uW)	RESULT
V_{normal}	30MHz to 1000MHz	701.482	0.000233	0.25	PASS
	1000MHz to 2387MHz	1206.663	0.294442	2.5	PASS
	2387MHz to 2400MHz	2399.964	13.899526	25	PASS
	2483.5MHz to 2496.5MHz	2483.927	8.649679	25	PASS
	2496.5MHz to 12500MHz	3609.389	0.120781	2.5	PASS
V_{max.}	30MHz to 1000MHz	551.011	0.000247	0.25	PASS
	1000MHz to 2387MHz	1201.115	0.289734	2.5	PASS
	2387MHz to 2400MHz	2399.704	14.723125	25	PASS
	2483.5MHz to 2496.5MHz	2483.586	8.974288	25	PASS
	2496.5MHz to 12500MHz	3633.147	0.126183	2.5	PASS
V_{min.}	30MHz to 1000MHz	933.191	0.000268	0.25	PASS
	1000MHz to 2387MHz	1201.115	0.280543	2.5	PASS
	2387MHz to 2400MHz	2399.216	11.994993	25	PASS
	2483.5MHz to 2496.5MHz	2484.099	7.396053	25	PASS
	2496.5MHz to 12500MHz	3630.646	0.118850	2.5	PASS

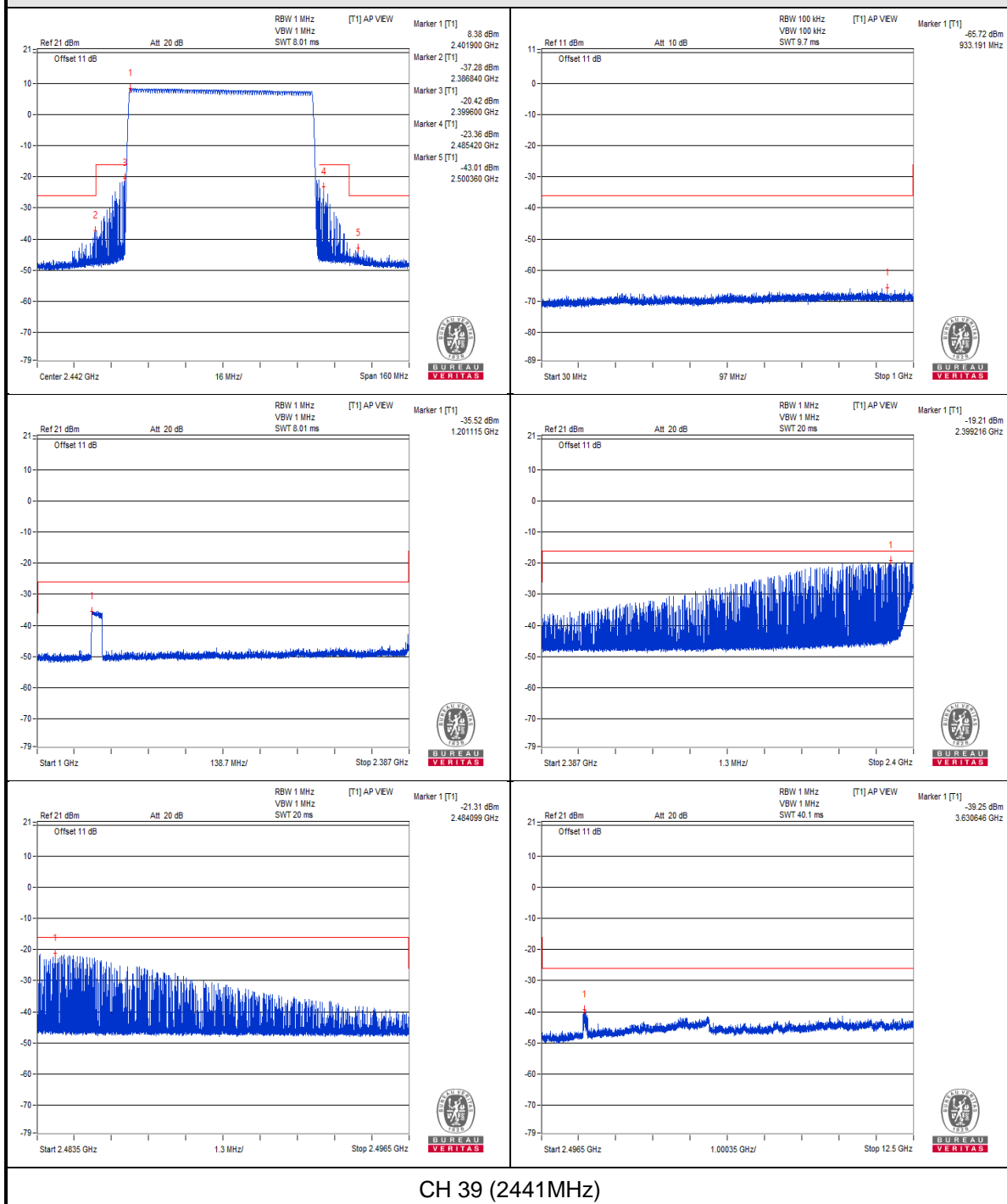
NOTE: 1. The spectrum plots are attached on the following pages.



V_{max}.



V_{min}.



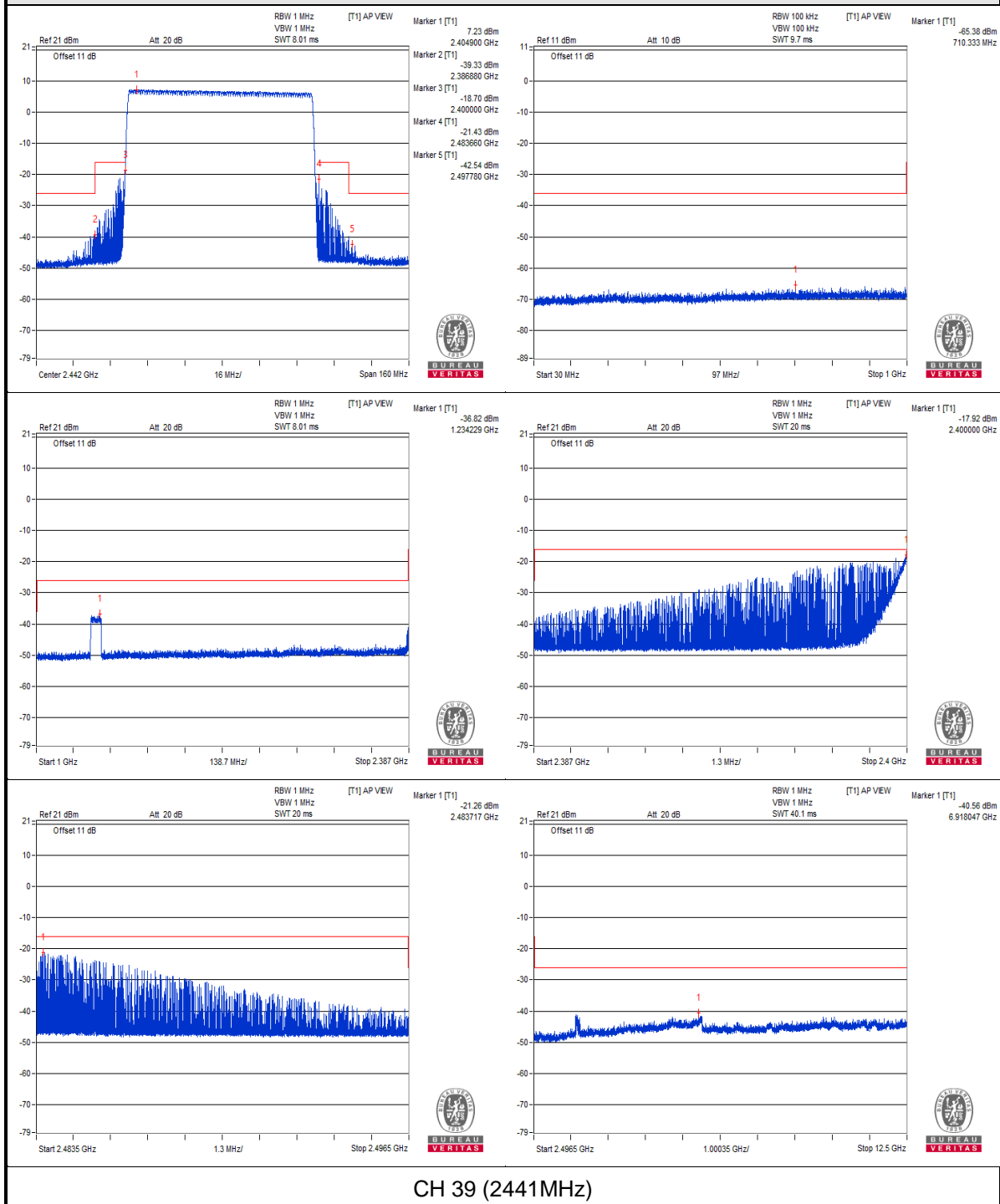
CH 39 (2441MHz)

Modulation: $\pi/4$ -DQPSK

TEST CHANNEL		CH 39 (2441MHz)			
TEST CONDITION	FREQUENCY RANGE(MHz)	FREQUENCY (MHz)	MEASURE. VALUE(μ W)	LIMIT (μ W)	RESULT
V_{normal}	30MHz to 1000MHz	710.333	0.000290	0.25	PASS
	1000MHz to 2387MHz	1234.229	0.207970	2.5	PASS
	2387MHz to 2400MHz	2400.000	16.143586	25	PASS
	2483.5MHz to 2496.5MHz	2483.717	7.481695	25	PASS
	2496.5MHz to 12500MHz	6918.047	0.087902	2.5	PASS
V_{max.}	30MHz to 1000MHz	773.747	0.000246	0.25	PASS
	1000MHz to 2387MHz	1236.483	0.204174	2.5	PASS
	2387MHz to 2400MHz	2400.000	15.631476	25	PASS
	2483.5MHz to 2496.5MHz	2484.039	7.161434	25	PASS
	2496.5MHz to 12500MHz	3606.888	0.095719	2.5	PASS
V_{min.}	30MHz to 1000MHz	885.176	0.000265	0.25	PASS
	1000MHz to 2387MHz	1223.133	0.230675	2.5	PASS
	2387MHz to 2400MHz	2399.996	15.667511	25	PASS
	2483.5MHz to 2496.5MHz	2483.670	8.222426	25	PASS
	2496.5MHz to 12500MHz	3651.904	0.084528	2.5	PASS

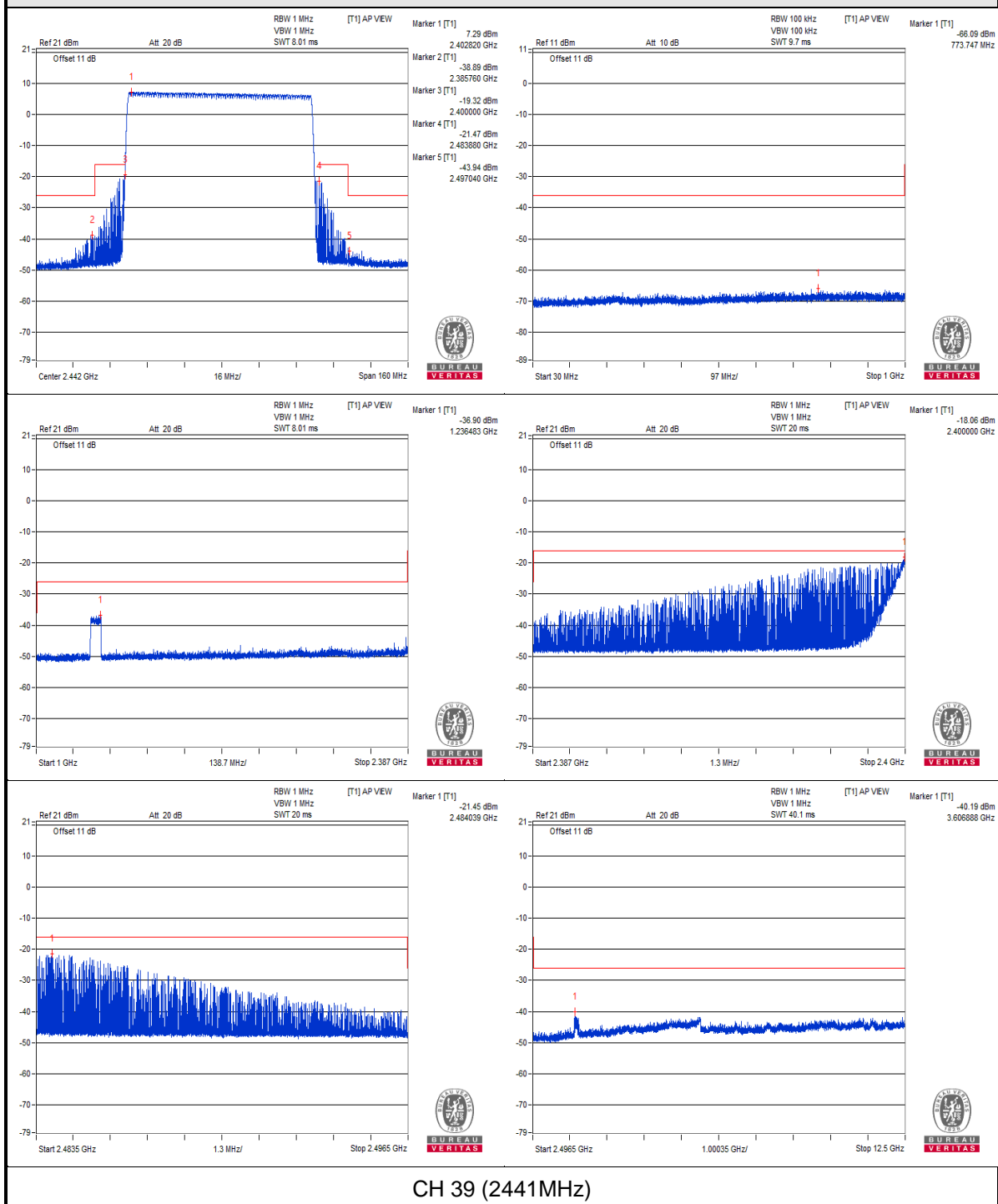
NOTE: 1. The spectrum plots are attached on the following pages.

Vnormal

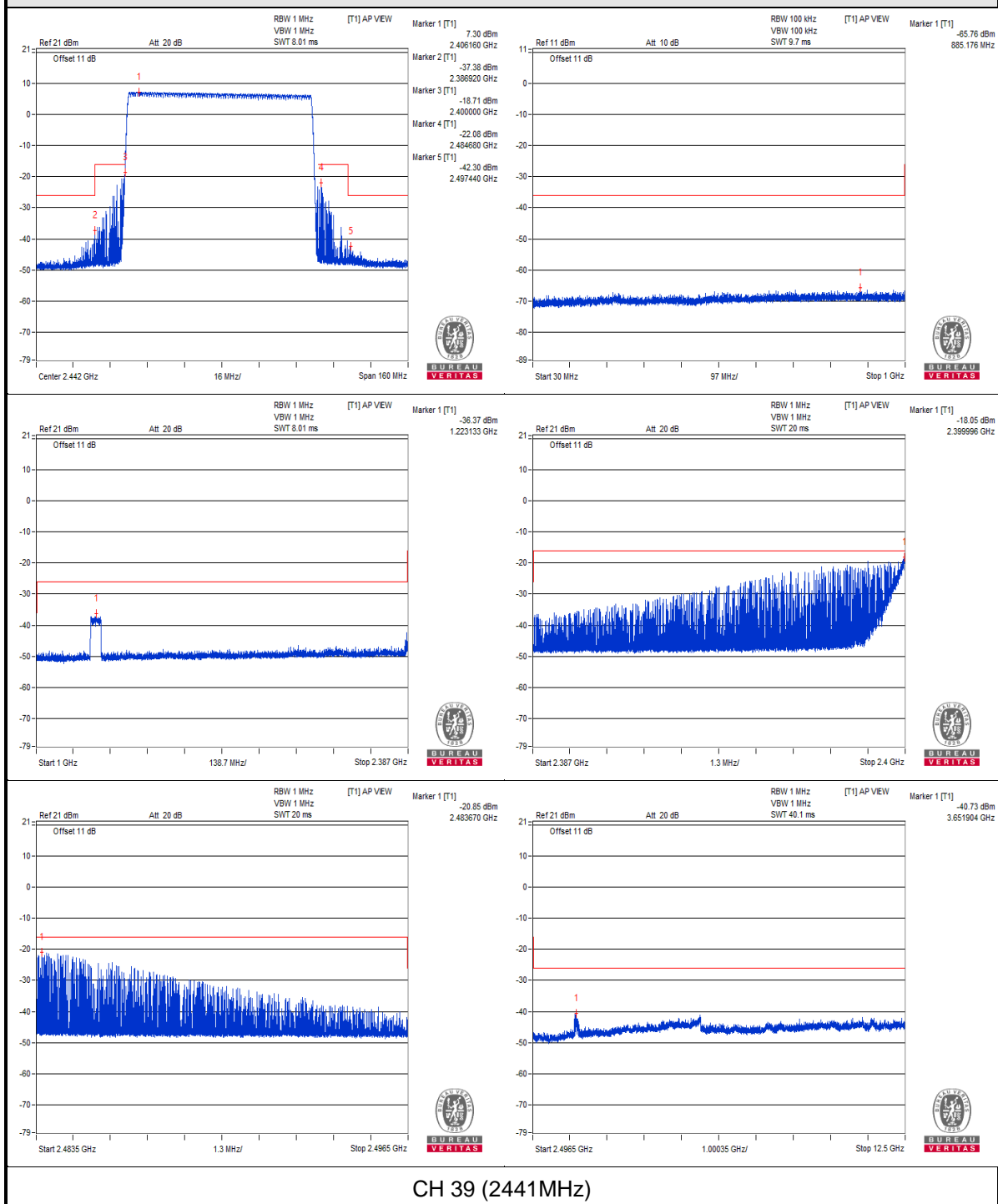


CH 39 (2441MHz)

V_{max}.



V min.

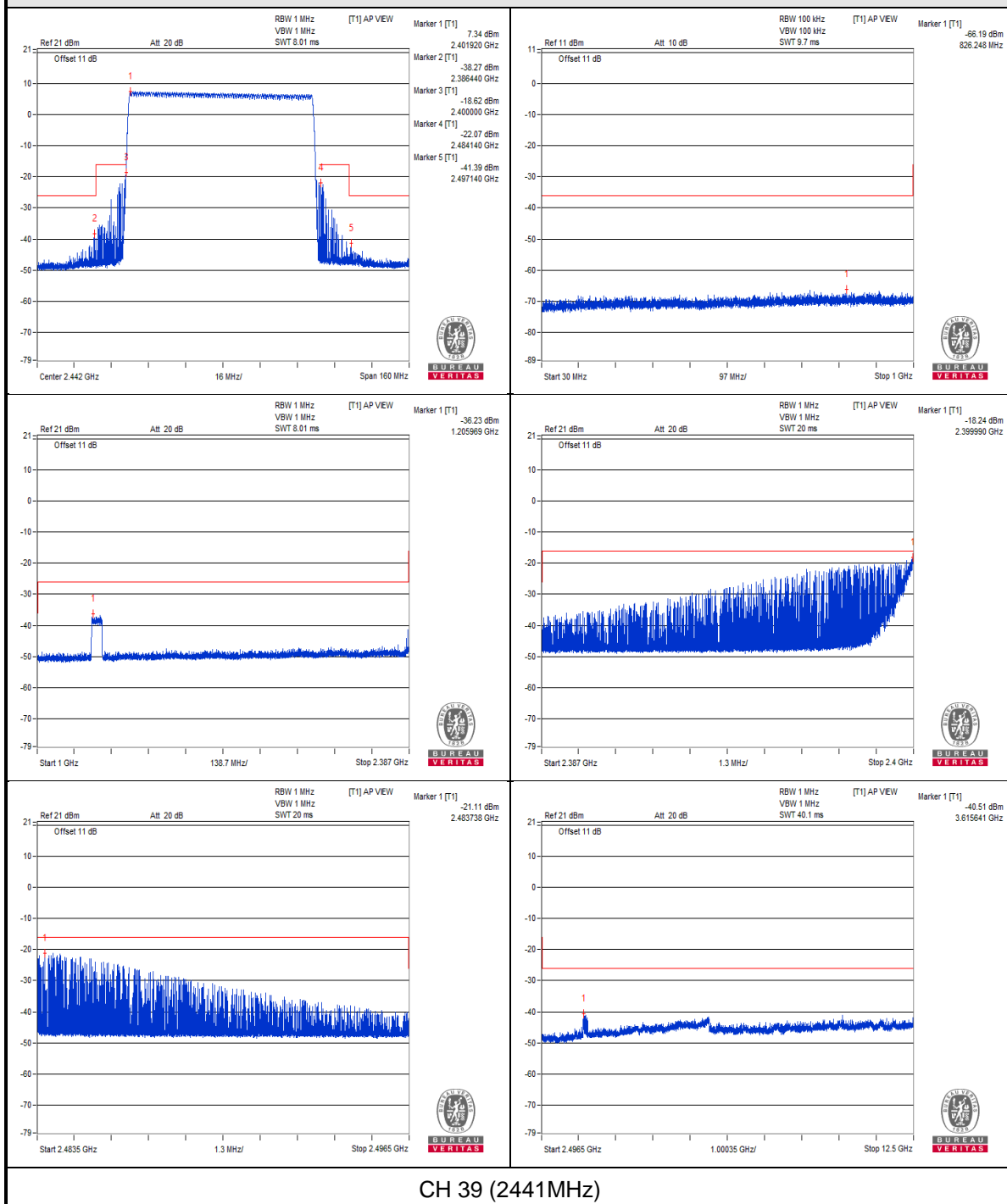


Modulation: 8DPSK

TEST CHANNEL		CH 39 (2441MHz)			
TEST CONDITION	FREQUENCY RANGE(MHz)	FREQUENCY (MHz)	MEASURE. VALUE(uW)	LIMIT (uW)	RESULT
V_{normal}	30MHz to 1000MHz	826.248	0.000240	0.25	PASS
	1000MHz to 2387MHz	1205.969	0.238232	2.5	PASS
	2387MHz to 2400MHz	2399.990	14.996848	25	PASS
	2483.5MHz to 2496.5MHz	2483.738	7.744618	25	PASS
	2496.5MHz to 12500MHz	3615.641	0.088920	2.5	PASS
V_{max.}	30MHz to 1000MHz	730.097	0.000274	0.25	PASS
	1000MHz to 2387MHz	1202.675	0.231739	2.5	PASS
	2387MHz to 2400MHz	2399.990	15.135612	25	PASS
	2483.5MHz to 2496.5MHz	2483.517	7.816278	25	PASS
	2496.5MHz to 12500MHz	6991.822	0.082794	2.5	PASS
V_{min.}	30MHz to 1000MHz	746.587	0.000259	0.25	PASS
	1000MHz to 2387MHz	1207.703	0.215278	2.5	PASS
	2387MHz to 2400MHz	2399.990	15.995580	25	PASS
	2483.5MHz to 2496.5MHz	2483.665	8.053784	25	PASS
	2496.5MHz to 12500MHz	3610.639	0.086298	2.5	PASS

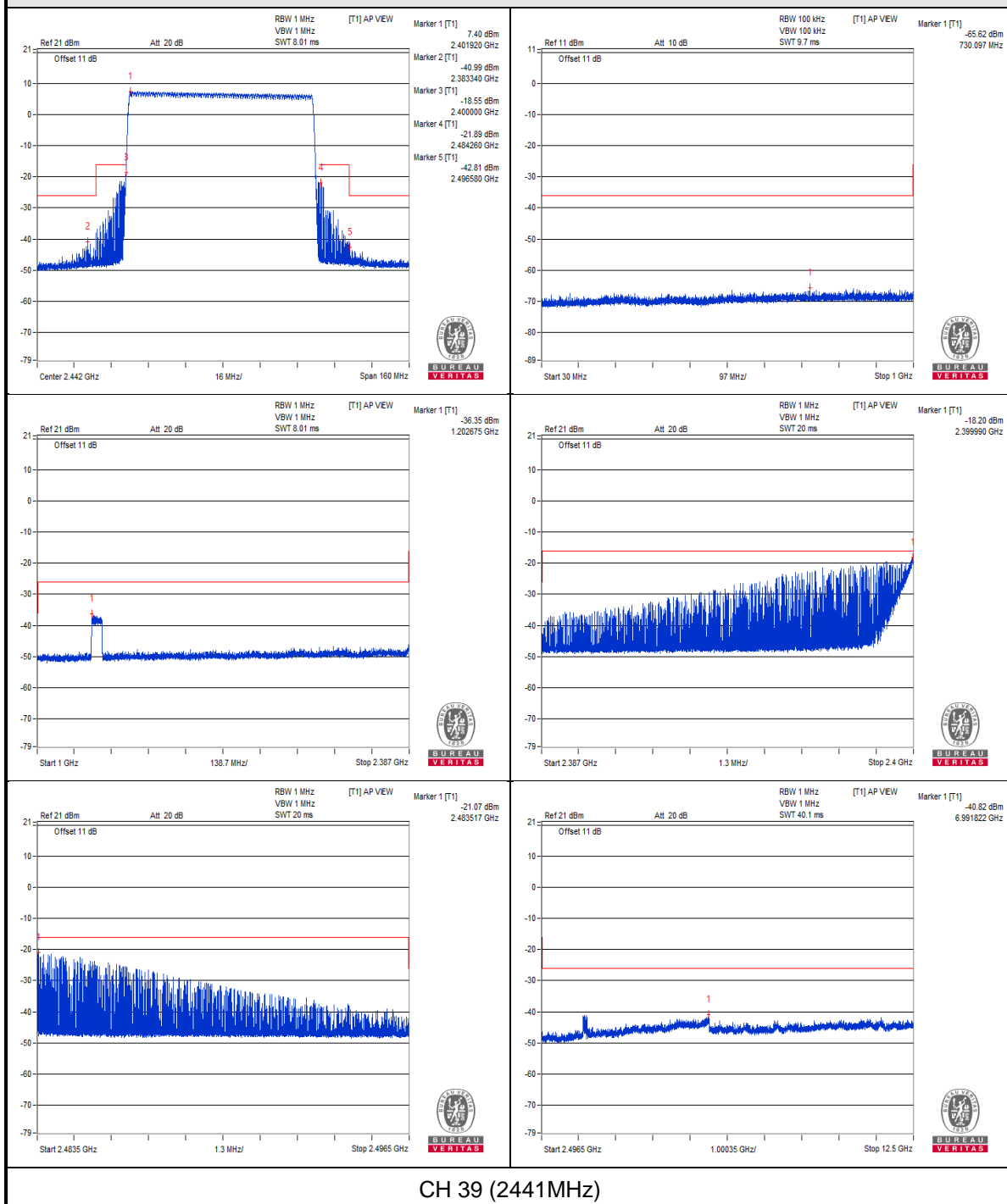
NOTE: 1. The spectrum plots are attached on the following pages.

Vnormal

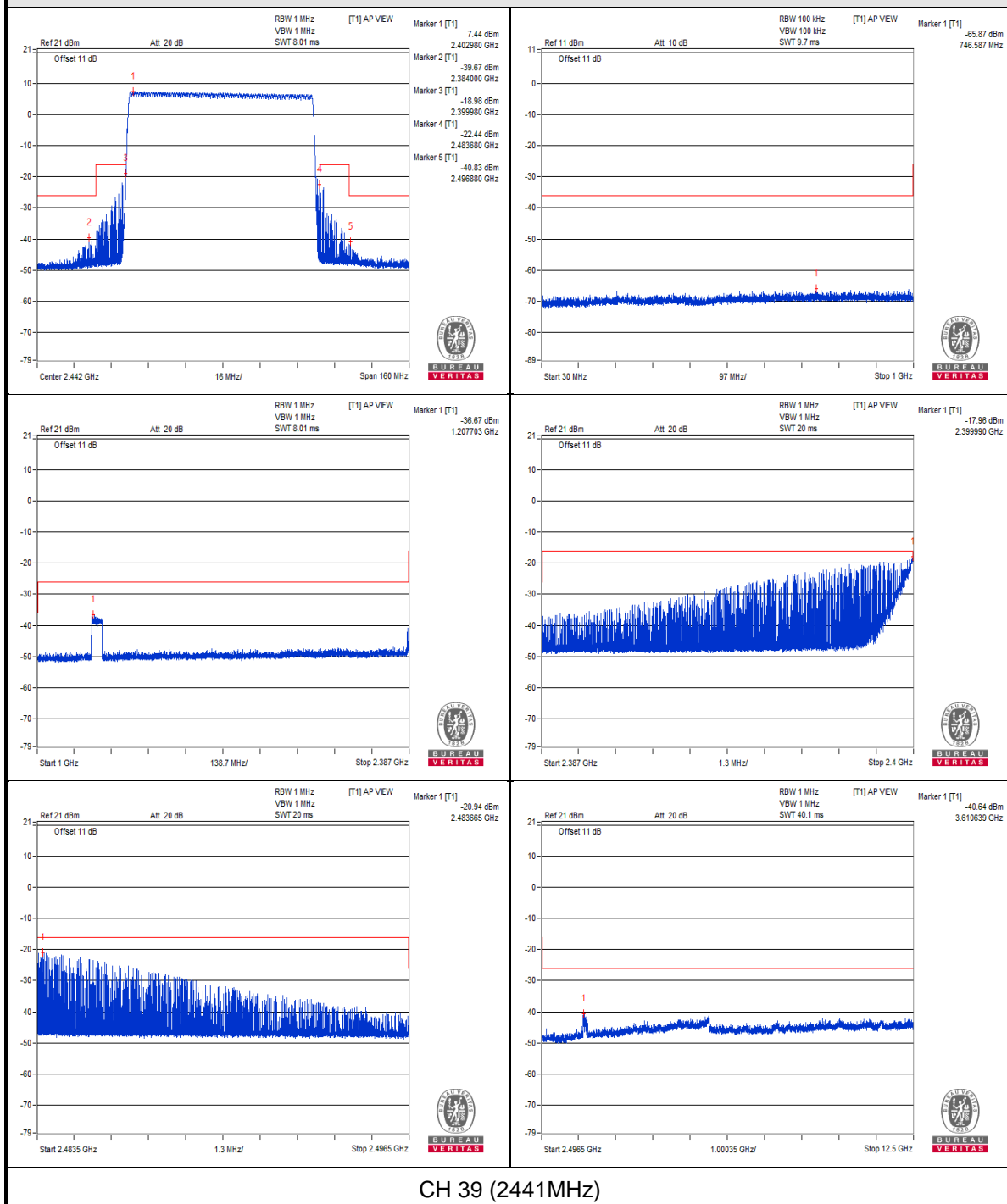


CH 39 (2441MHz)

V_{max}.



V_{min}.



CH 39 (2441MHz)

4.5 Antenna Power Measurement

4.5.1 Limits of Antenna Power

Modulation System	Frequency Band Used	Antenna Power (Max.)	EIRP Limit (Note 3)
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 (4.909 mW/MHz ~ 49.09 mW/MHz)

Note:

1. Occupied bandwidth is less than 26MHz
2. Occupied bandwidth is more than 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:

PCB antenna with antenna gain: 4.74 dBi

Voltage (Vdc)	Modulation	Data Rate	Conducted RF Output Power Density (mW/MHz)	Radiated RF Output Power Density (mW/MHz)
3.3	BT GFSK	DH5	0.083115	0.247559
	BT DQPSK	2DH5	0.047154	0.140449
	BT 8DPSK	3DH5	0.046591	0.138772
3.63	BT GFSK	DH5	0.08502	0.253233
	BT DQPSK	2DH5	0.047653	0.141935
	BT 8DPSK	3DH5	0.048204	0.143576
2.97	BT GFSK	DH5	0.08424	0.25091
	BT DQPSK	2DH5	0.048787	0.145313
	BT 8DPSK	3DH5	0.045449	0.135371
Max. Limit (mW/MHz):			3	-
Rated Power (mW/MHz):			0.1	-
Tolerance of Antenna Power (mW/MHz):			0.02 ~ 0.12	-
Max. EIRP Limit (mW/MHz):			-	4.909

- Note: 1. The radiated RF output power density is a “calculated” value derived from the conducted value.
 2. Formula: Radiated RF output power density = Conducted RF output power density + Maximum Antenna Gain

AFH Mode:

PCB antenna with antenna gain: 4.74 dBi

Voltage (Vdc)	Modulation	Data Rate	Conducted RF Output Power Density (mW/MHz)	Radiated RF Output Power Density (mW/MHz)
3.3	BT GFSK	DH5	0.325897	0.97069
	BT DQPSK	2DH5	0.183764	0.547344
	BT 8DPSK	3DH5	0.181385	0.540258
3.63	BT GFSK	DH5	0.334259	0.995596
	BT DQPSK	2DH5	0.186039	0.55412
	BT 8DPSK	3DH5	0.18819	0.560527
2.97	BT GFSK	DH5	0.331192	0.986461
	BT DQPSK	2DH5	0.189934	0.565722
	BT 8DPSK	3DH5	0.176443	0.525538
Max. Limit (mW/MHz):			3	-
Rated Power (mW/MHz):			0.4	-
Tolerance of Antenna Power (mW/MHz):			0.08 ~ 0.48	-
Max. EIRP Limit (mW/MHz):			-	4.909

- Note: 1. The radiated RF output power density is a “calculated” value derived from the conducted value.
 2. Formula: Radiated RF output power density = Conducted RF output power density + Maximum Antenna Gain

4.6 Spurious Emissions for Receiver

4.6.1 Limits of Spurious Emissions for Receiver

Frequencies (MHz)	Limit
Below 1GHz	$\leq 4\text{nW}/100\text{kHz}$ (-54dBm)
Above 1GHz	$\leq 20\text{nW}/\text{MHz}$ (-47dBm)

4.6.2 Test Setup

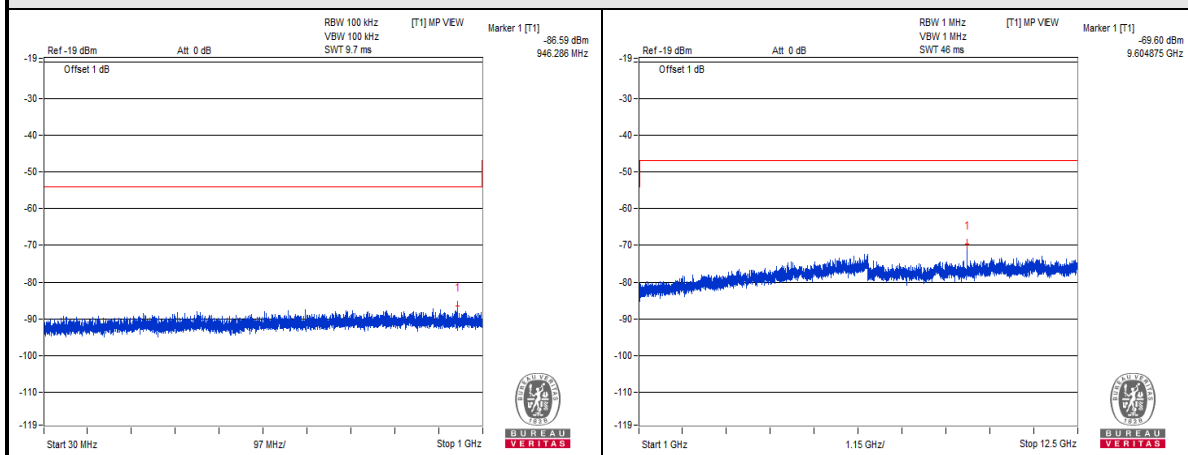


4.6.3 Test Result

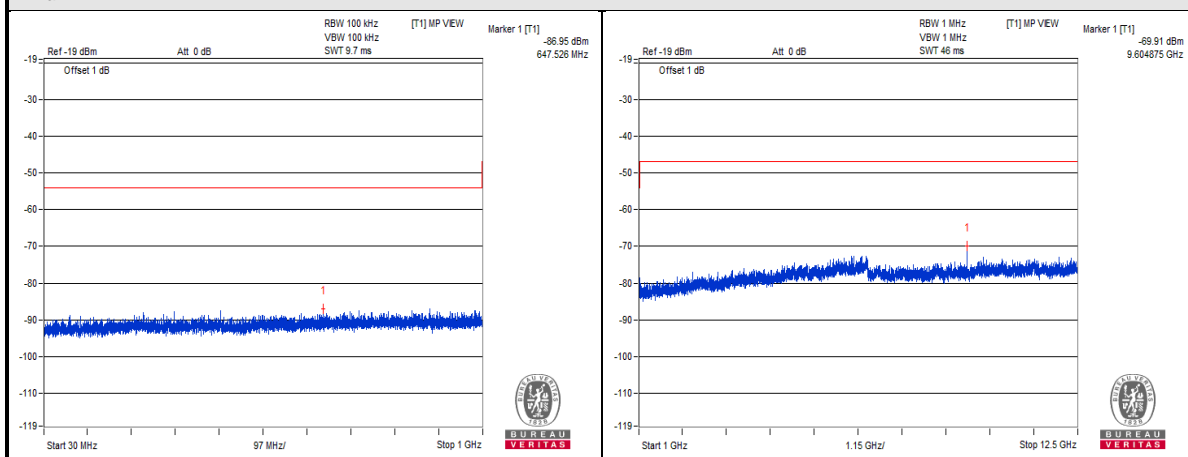
TEST CHANNEL		CH 0 (2402MHz)			
TEST CONDITION	FREQUENCY RANGE(MHz)	FREQUENCY (MHz)	MEASURE. VALUE(nW)	LIMIT (nW)	RESULT
V_{normal}	30MHz to 1000MHz	946.286	0.002193	4.0	PASS
	1000MHz to 12500MHz	9604.875	0.109648	20.0	PASS
V_{max.}	30MHz to 1000MHz	647.526	0.002018	4.0	PASS
	1000MHz to 12500MHz	9604.875	0.102094	20.0	PASS
V_{min.}	30MHz to 1000MHz	791.207	0.001963	4.0	PASS
	1000MHz to 12500MHz	9604.875	0.101158	20.0	PASS
TEST CHANNEL		CH 39 (2441MHz)			
V_{normal}	30MHz to 1000MHz	947.620	0.002193	4.0	PASS
	1000MHz to 12500MHz	6949.812	0.059979	20.0	PASS
V_{max.}	30MHz to 1000MHz	837.888	0.002004	4.0	PASS
	1000MHz to 12500MHz	6991.500	0.068549	20.0	PASS
V_{min.}	30MHz to 1000MHz	853.287	0.002032	4.0	PASS
	1000MHz to 12500MHz	6981.437	0.051404	20.0	PASS
TEST CHANNEL		CH 78 (2480MHz)			
V_{normal}	30MHz to 1000MHz	670.685	0.002104	4.0	PASS
	1000MHz to 12500MHz	9916.812	0.117490	20.0	PASS
V_{max.}	30MHz to 1000MHz	770.837	0.001820	4.0	PASS
	1000MHz to 12500MHz	9916.812	0.091201	20.0	PASS
V_{min.}	30MHz to 1000MHz	861.290	0.002163	4.0	PASS
	1000MHz to 12500MHz	9916.812	0.117761	20.0	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.

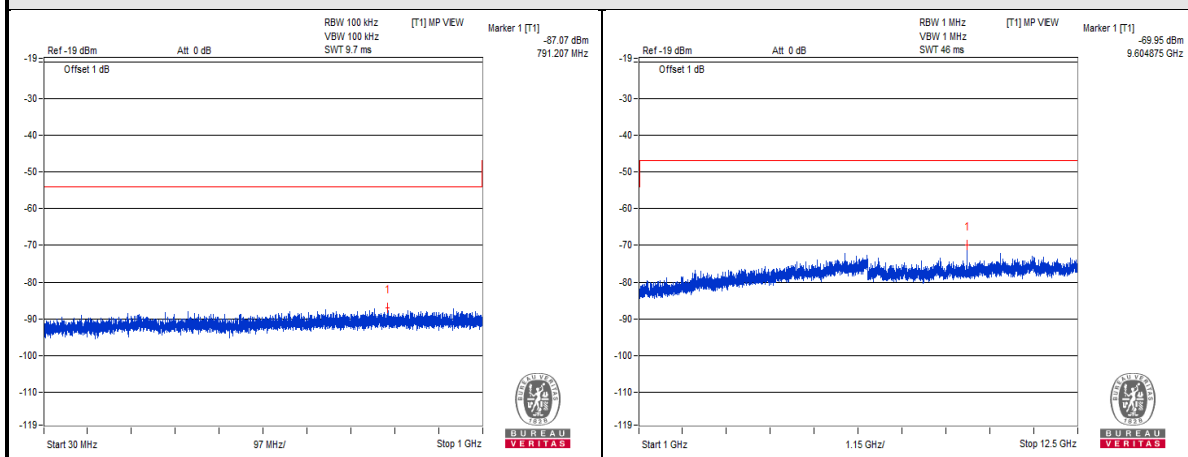
V_{normal}



V_{max}

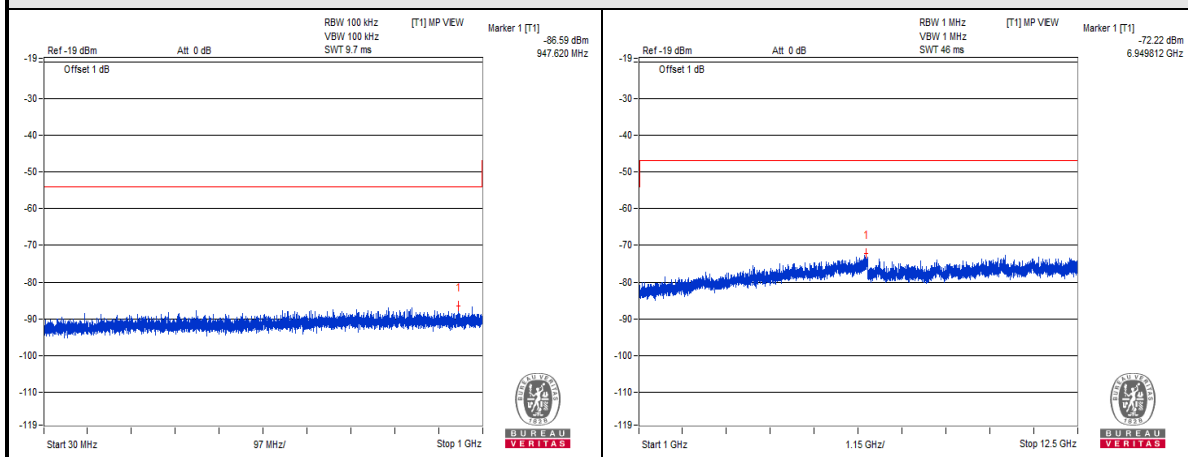


V_{min}

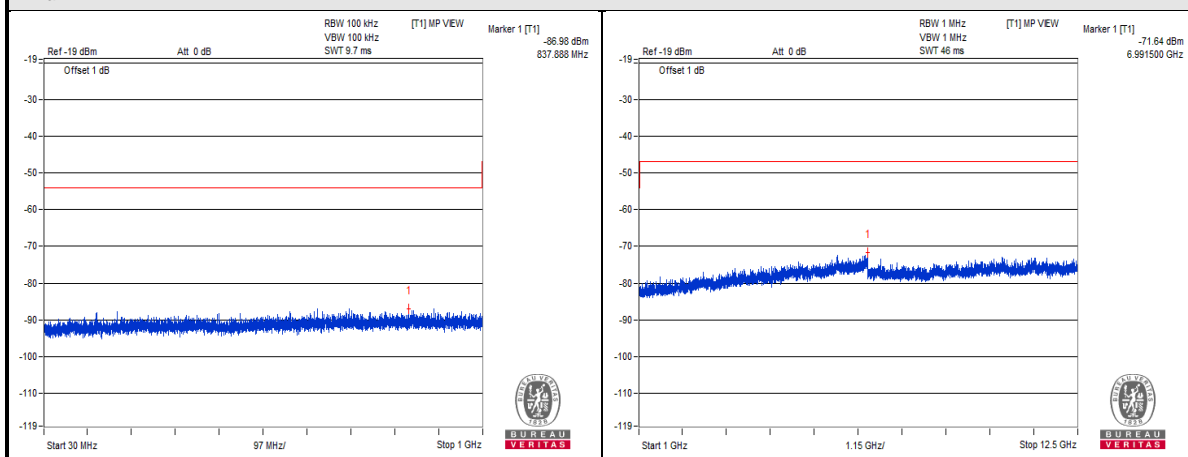


CH 0 (2402MHz)

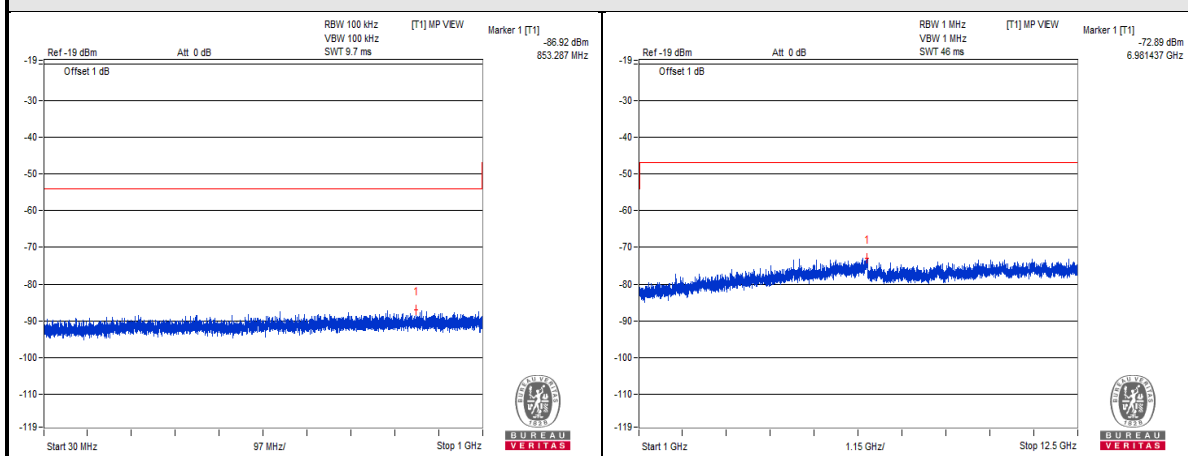
V_{normal}



V_{max}

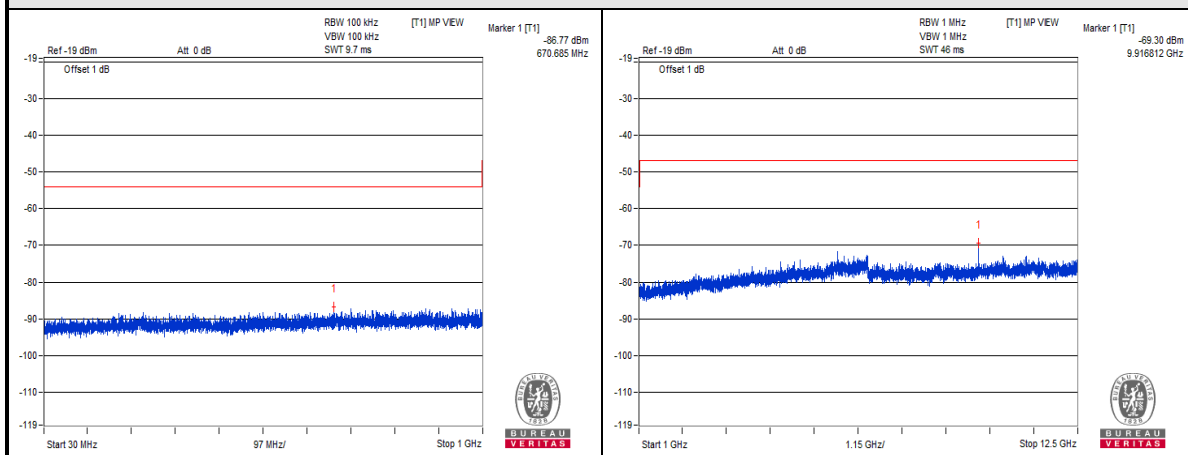


V_{min}

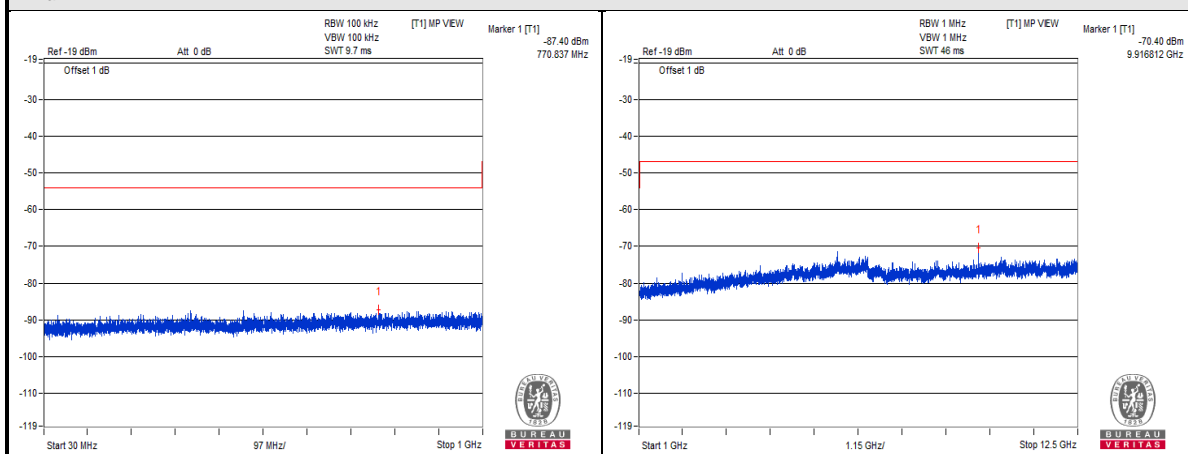


CH 39 (2441MHz)

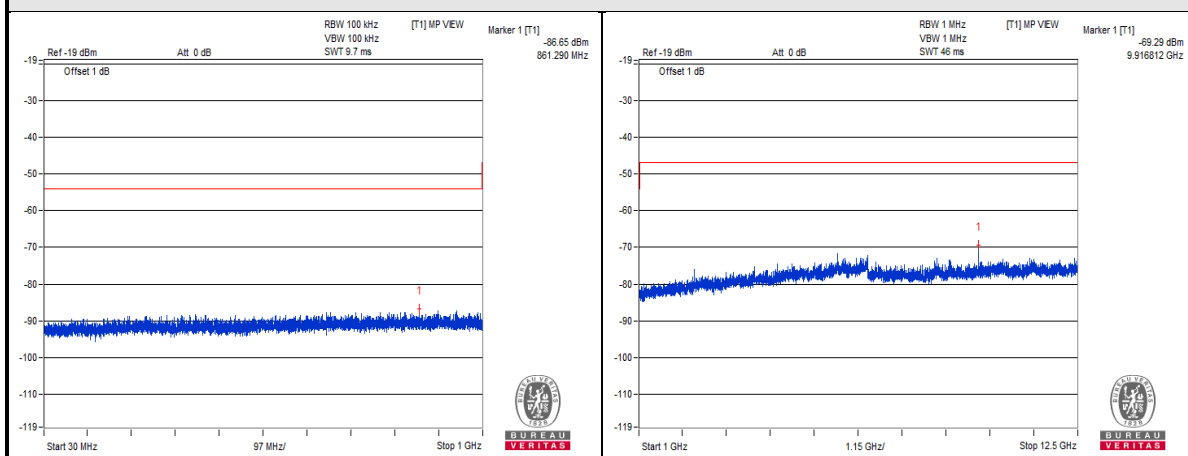
V_{normal}



V_{max}



V_{min}



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



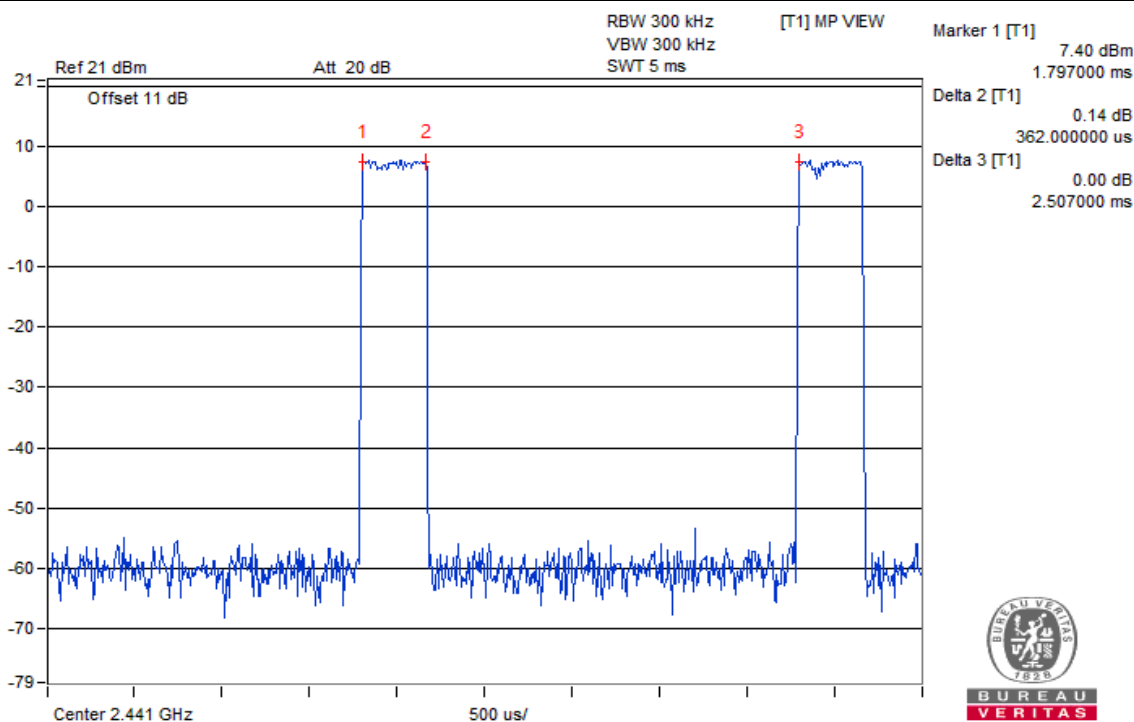
4.7.3 Test Result

Modulation: GFSK

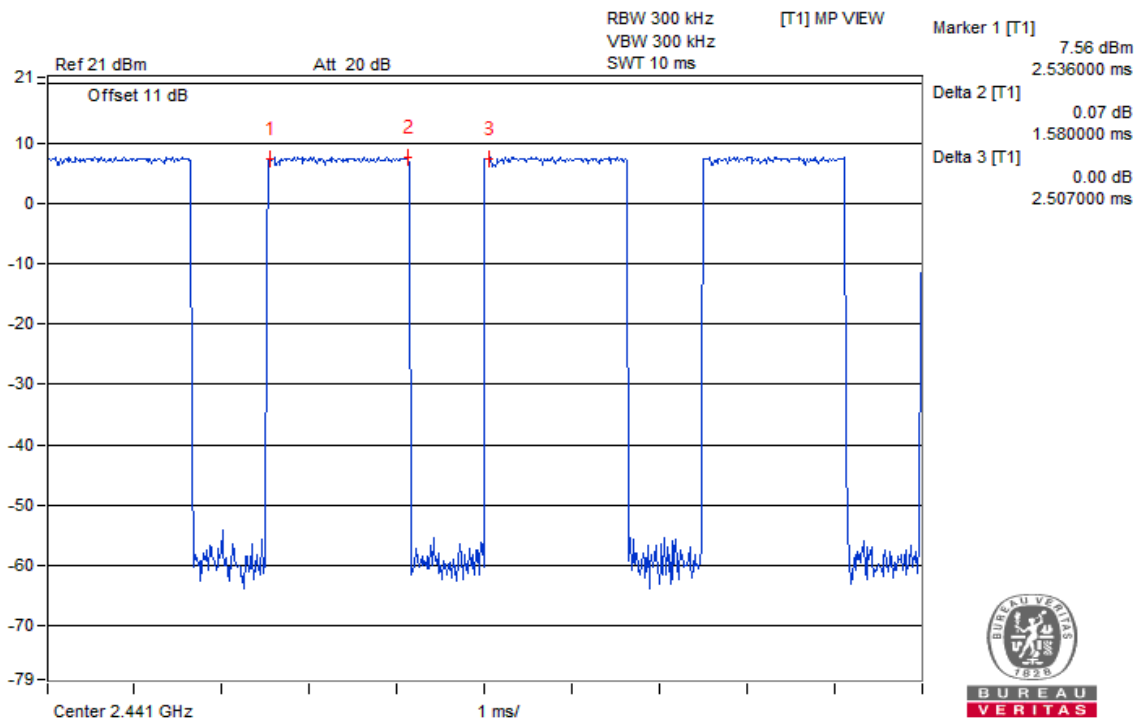
Normal Mode:

Test Condition	Mode	Spreading Rate	$(\text{Spreading Rate}/79)*0.4$	Duty Cycle (msec)	Result (msec)	Limit (msec)
V_{normal}	DH1	71.01	0.359	0.144	51.696	400
	DH3	71.01	0.359	0.630	226.170	400
	DH5	71.01	0.359	0.565	202.835	400
$V_{\text{max.}}$	DH1	71.20	0.360	0.142	51.120	400
	DH3	71.20	0.360	0.624	224.640	400
	DH5	71.20	0.360	0.558	200.880	400
$V_{\text{min.}}$	DH1	71.20	0.360	0.142	51.120	400
	DH3	71.20	0.360	0.623	224.280	400
	DH5	71.20	0.360	0.565	203.400	400

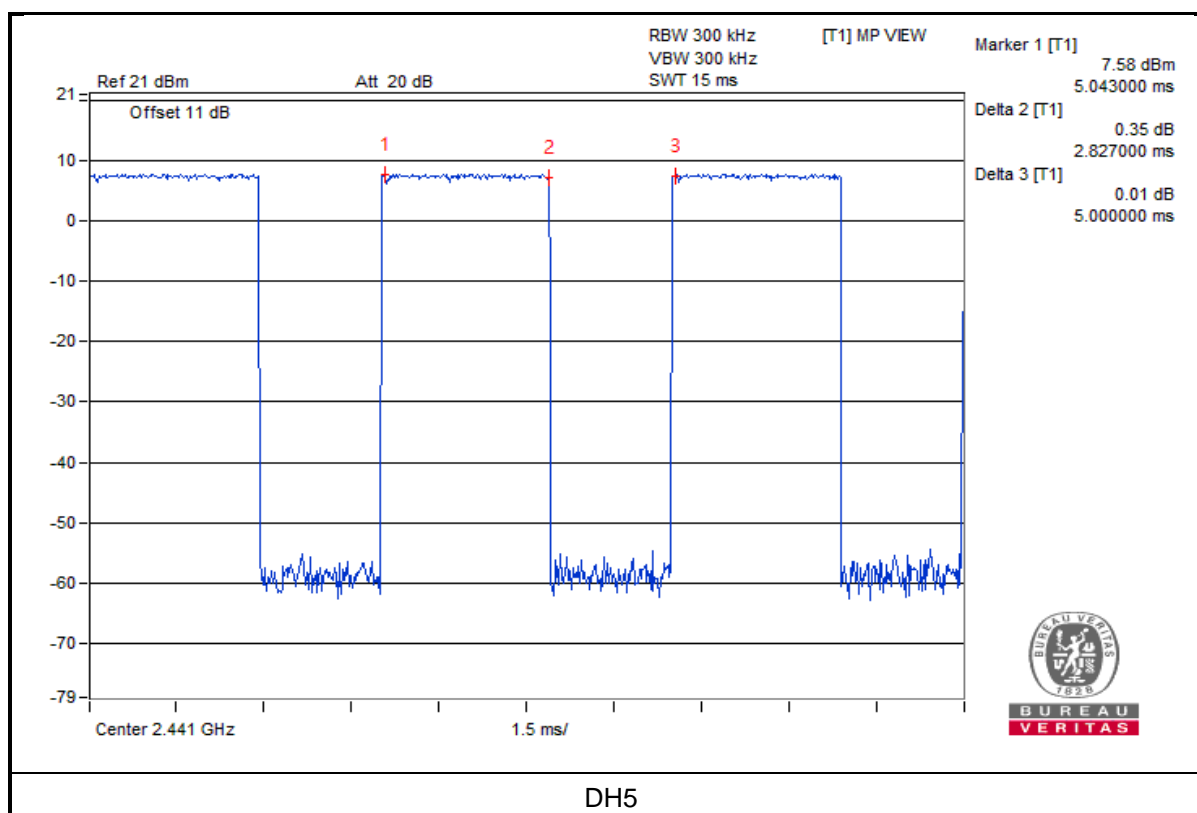
V_{normal}



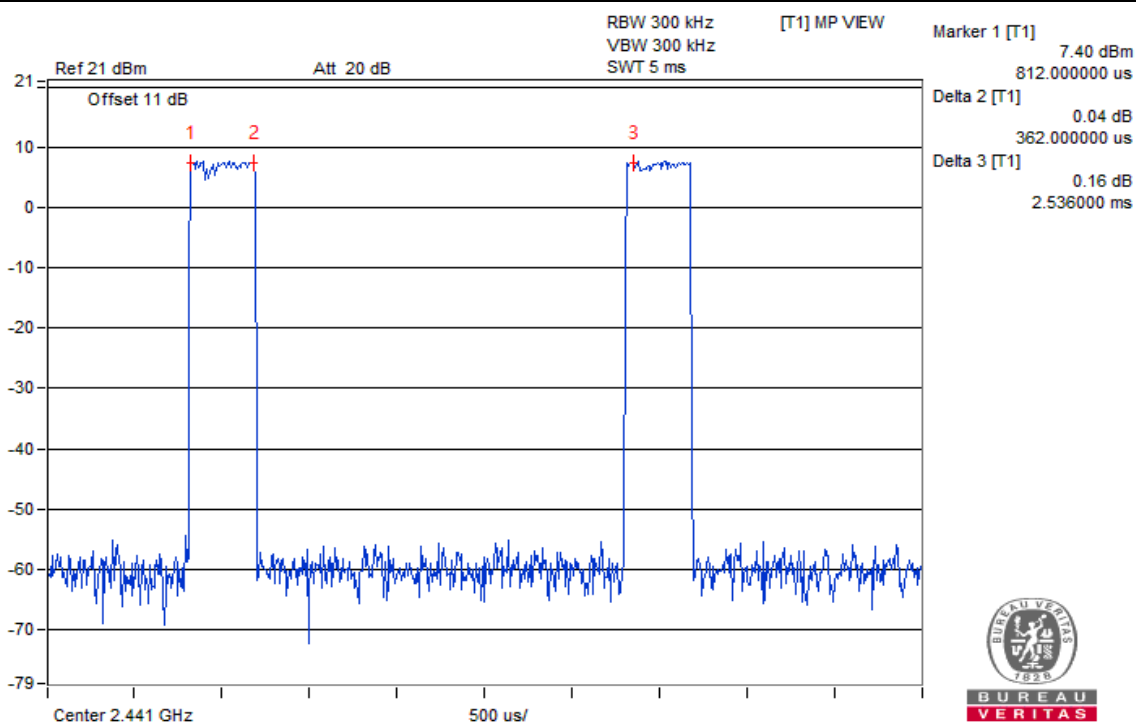
DH1



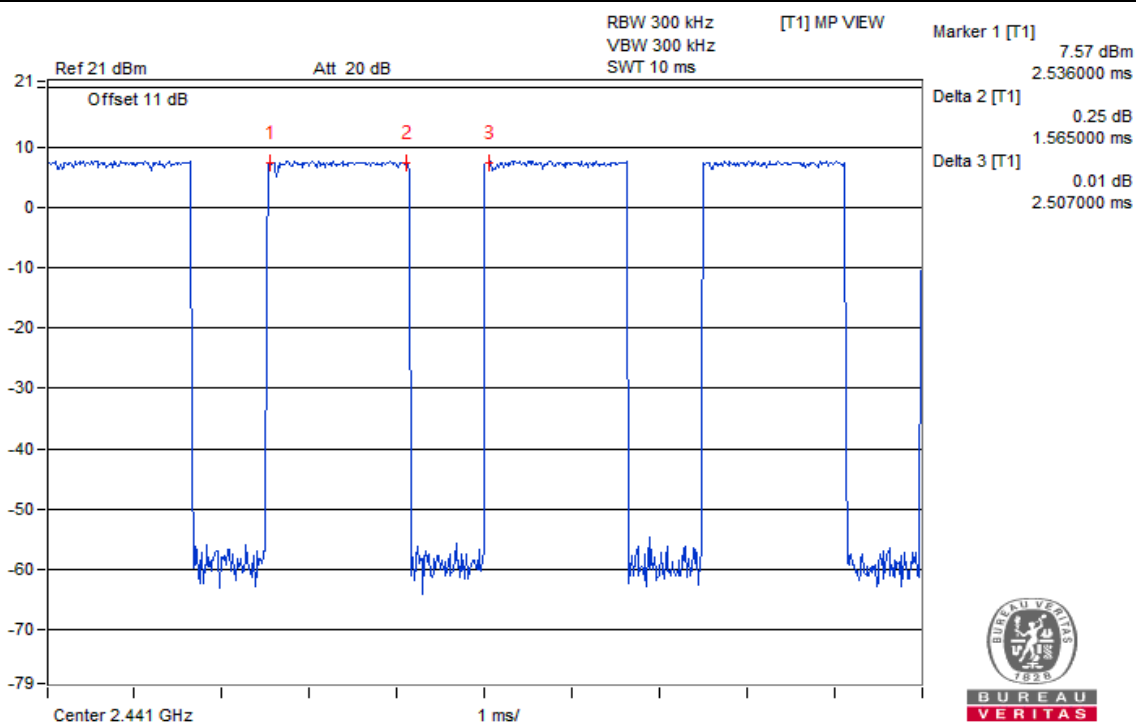
DH3



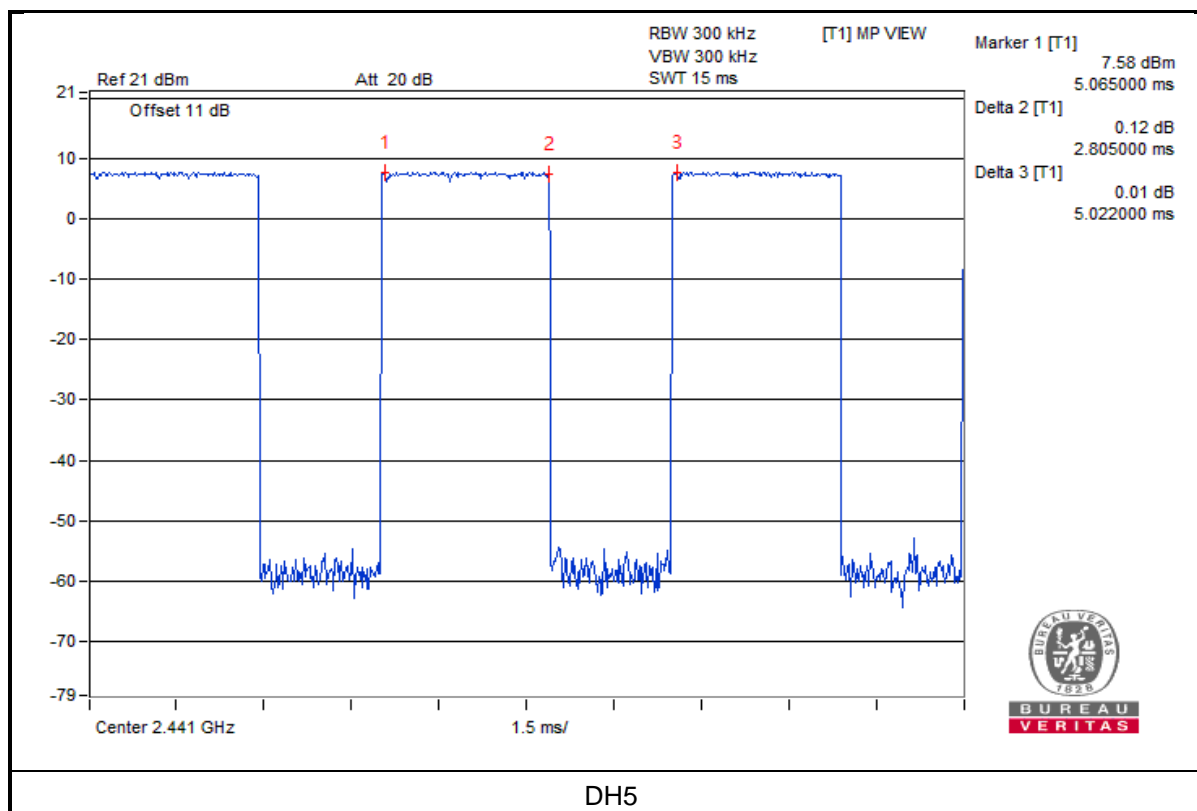
V_{max}.



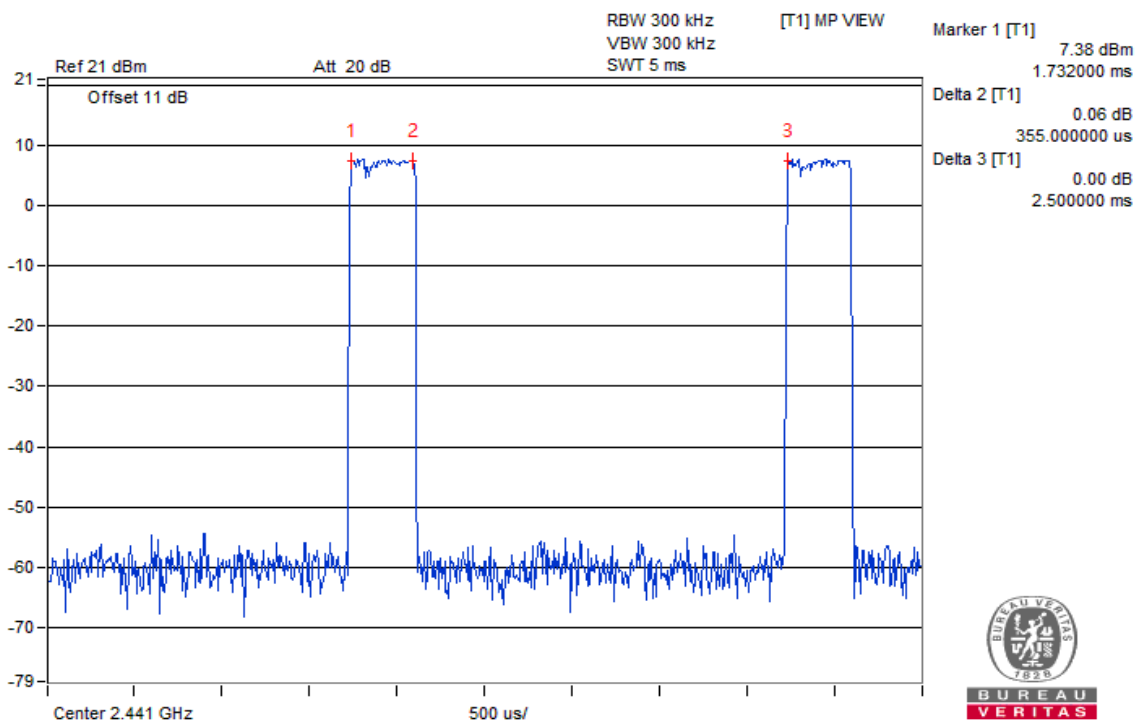
DH1



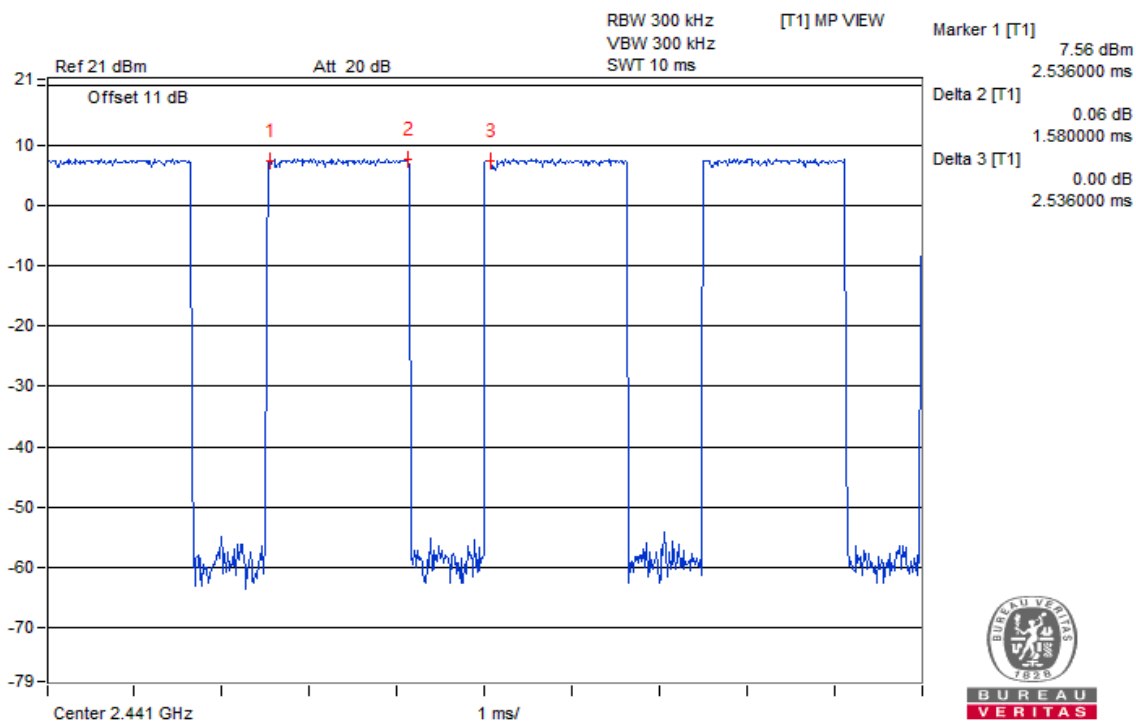
DH3



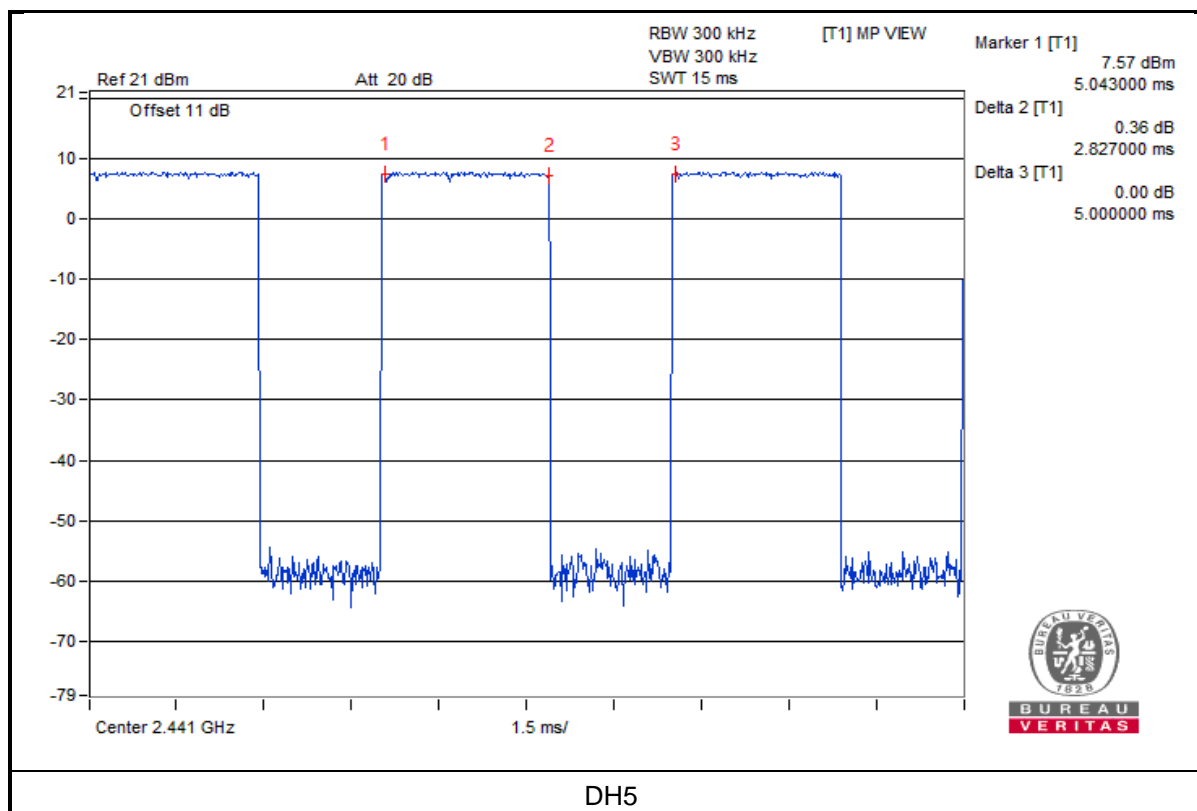
V_{min}.



DH1



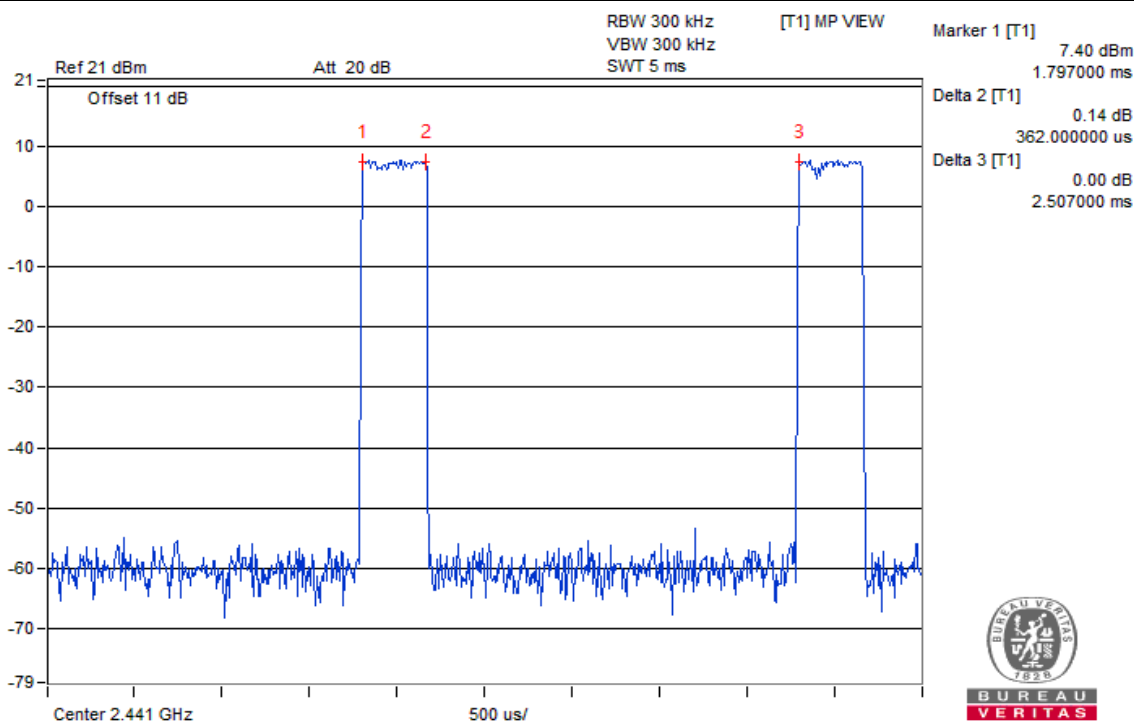
DH3



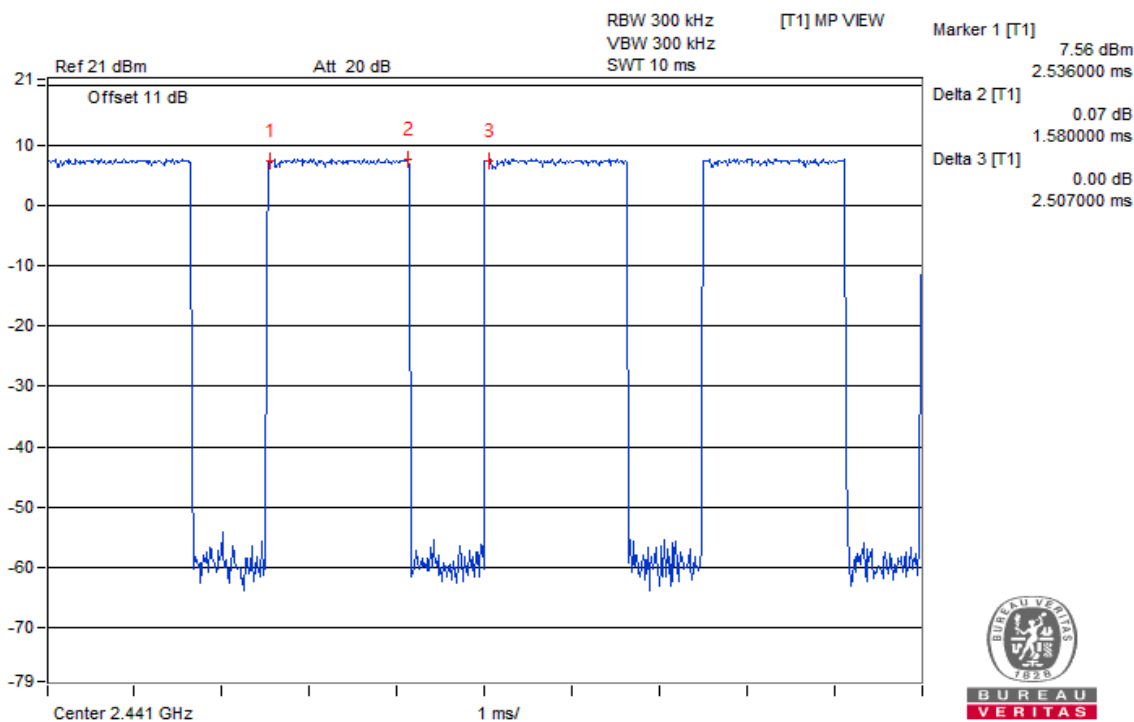
AFH Mode:

Test Condition	Mode	Spreading Rate	$(\text{Spreading Rate}/20)*0.4$	Duty Cycle (msec)	Result (msec)	Limit (msec)
V_{normal}	DH1	18.11	0.362	0.144	52.128	400
	DH3	18.11	0.362	0.630	228.060	400
	DH5	18.11	0.362	0.565	204.530	400
V_{max.}	DH1	18.11	0.362	0.142	51.404	400
	DH3	18.11	0.362	0.624	225.888	400
	DH5	18.11	0.362	0.558	201.996	400
V_{min.}	DH1	18.11	0.362	0.142	51.404	400
	DH3	18.11	0.362	0.623	225.526	400
	DH5	18.11	0.362	0.565	204.530	400

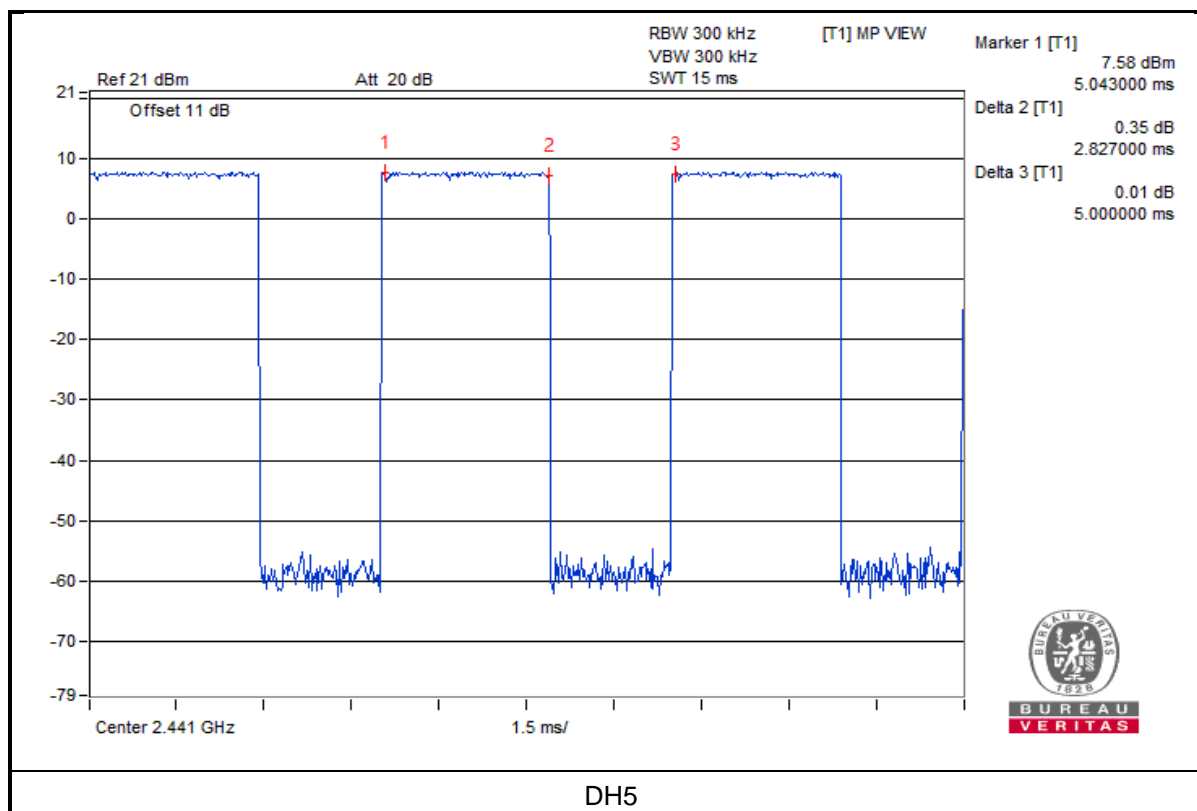
V_{normal}



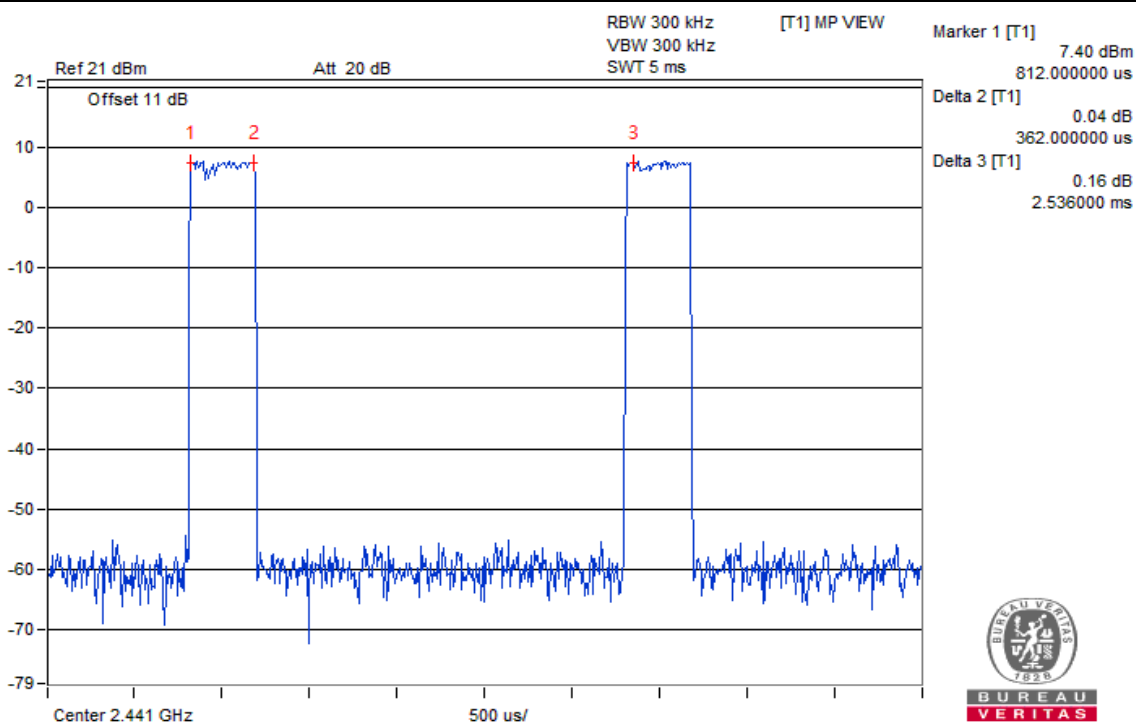
DH1



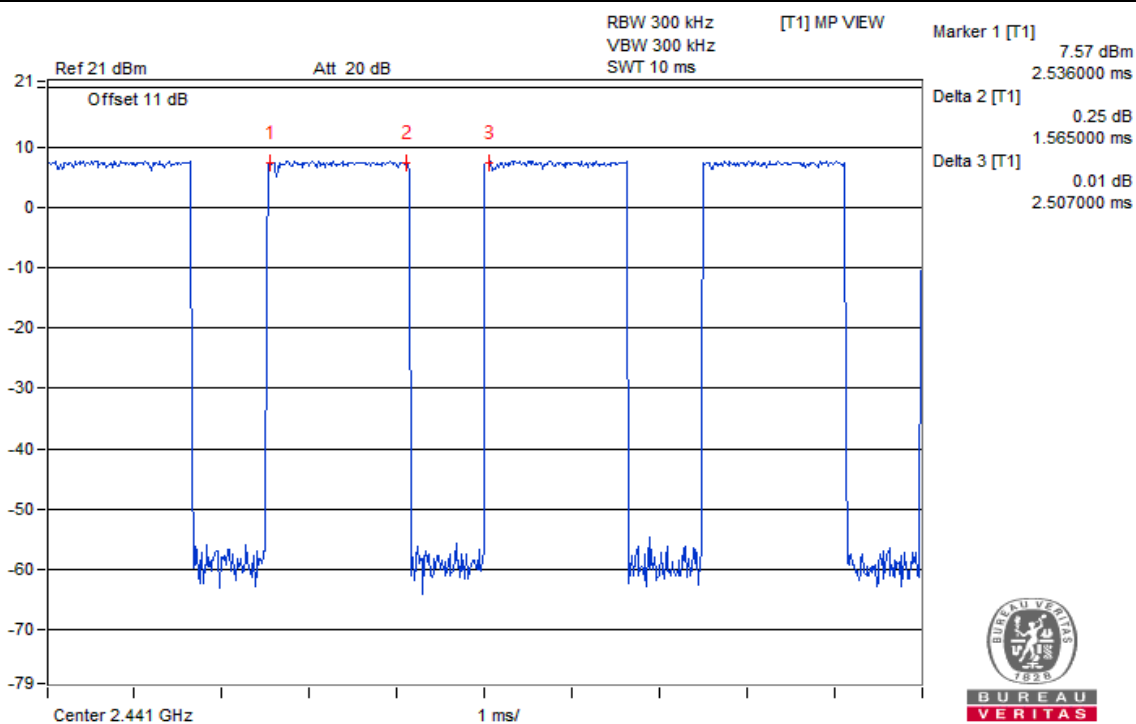
DH3



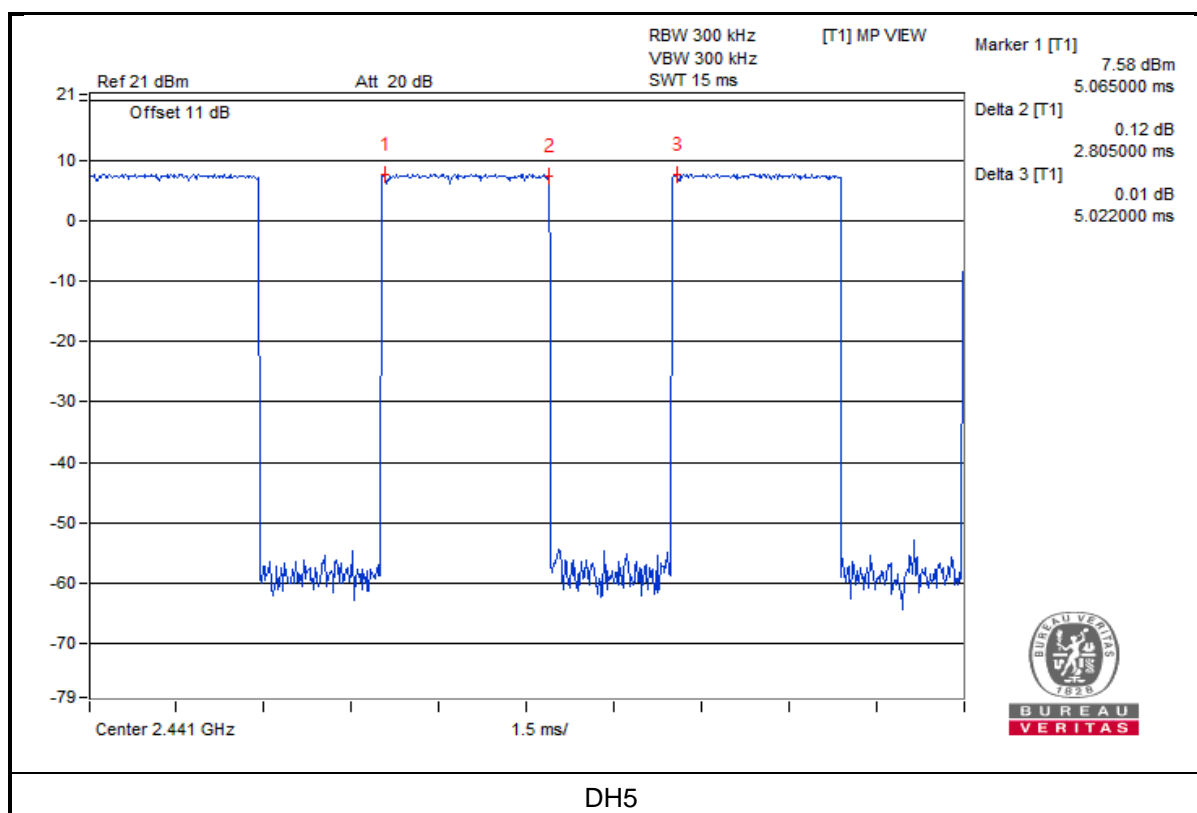
V_{max}.



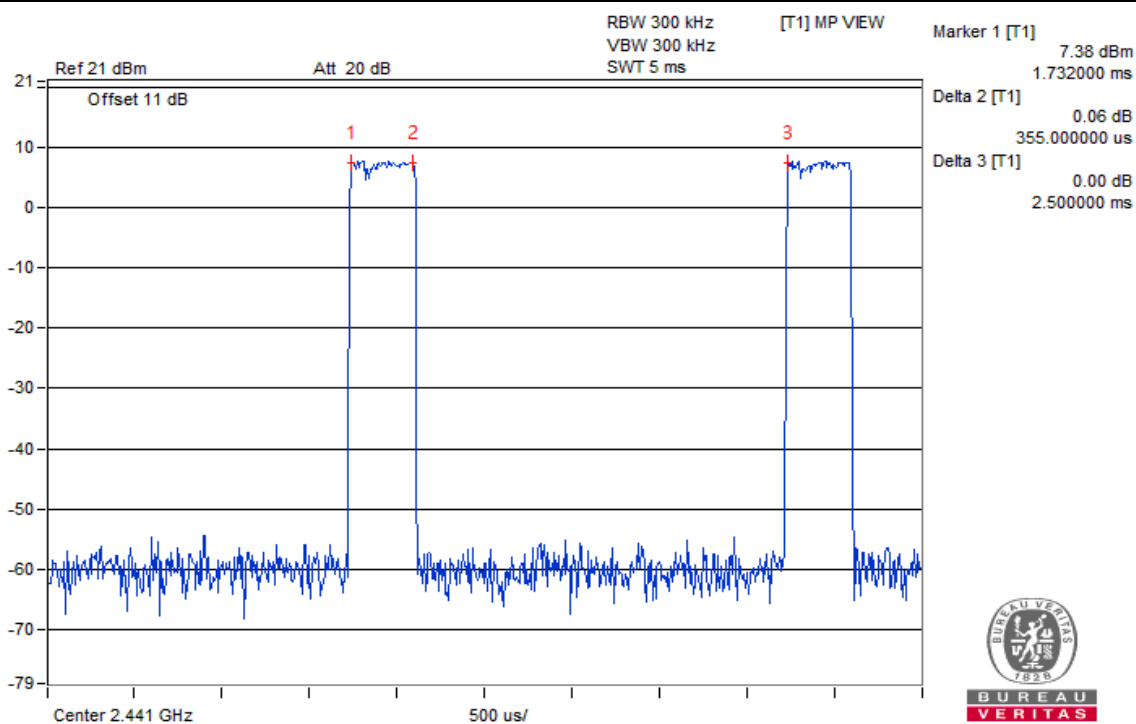
DH1



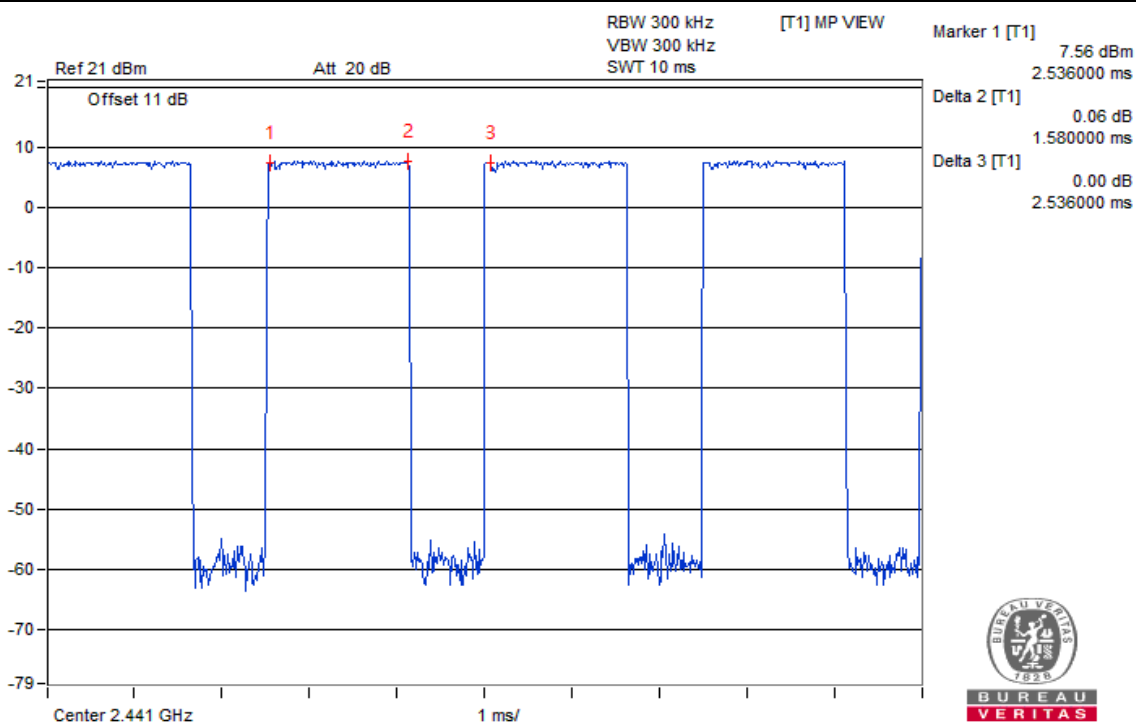
DH3



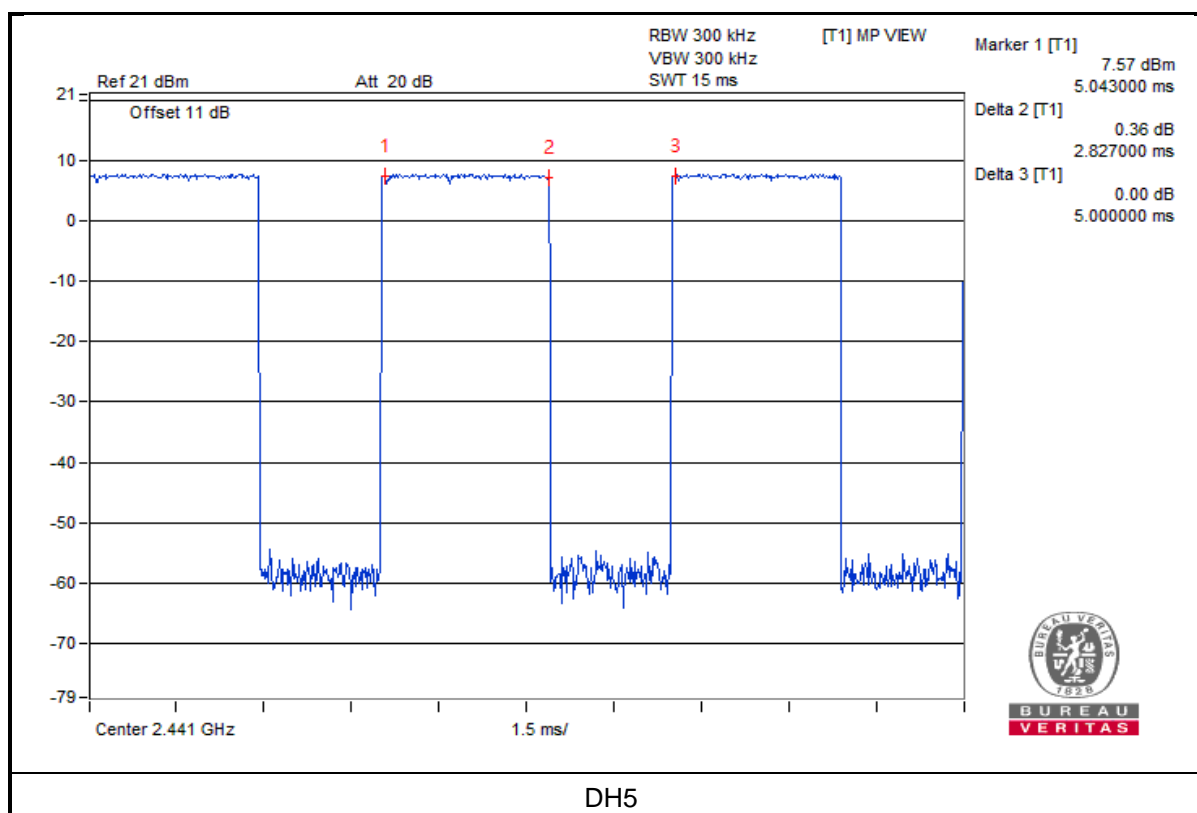
V_{min}.



DH1



DH3

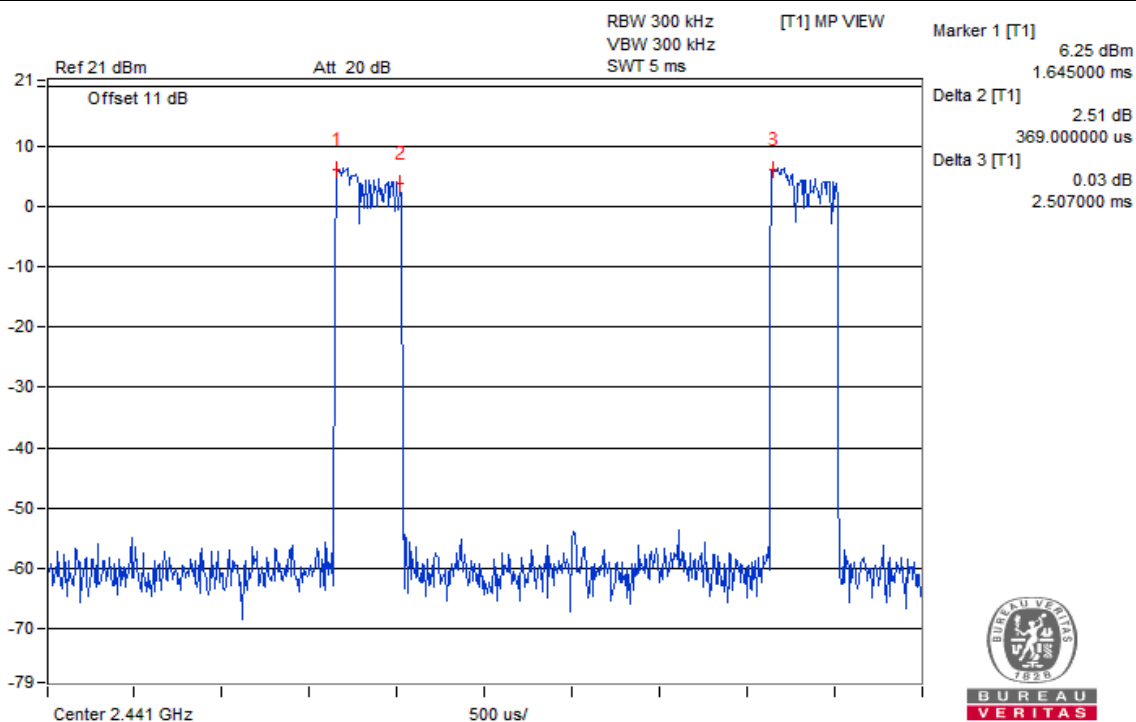


Modulation: $\pi/4$ -DQPSK

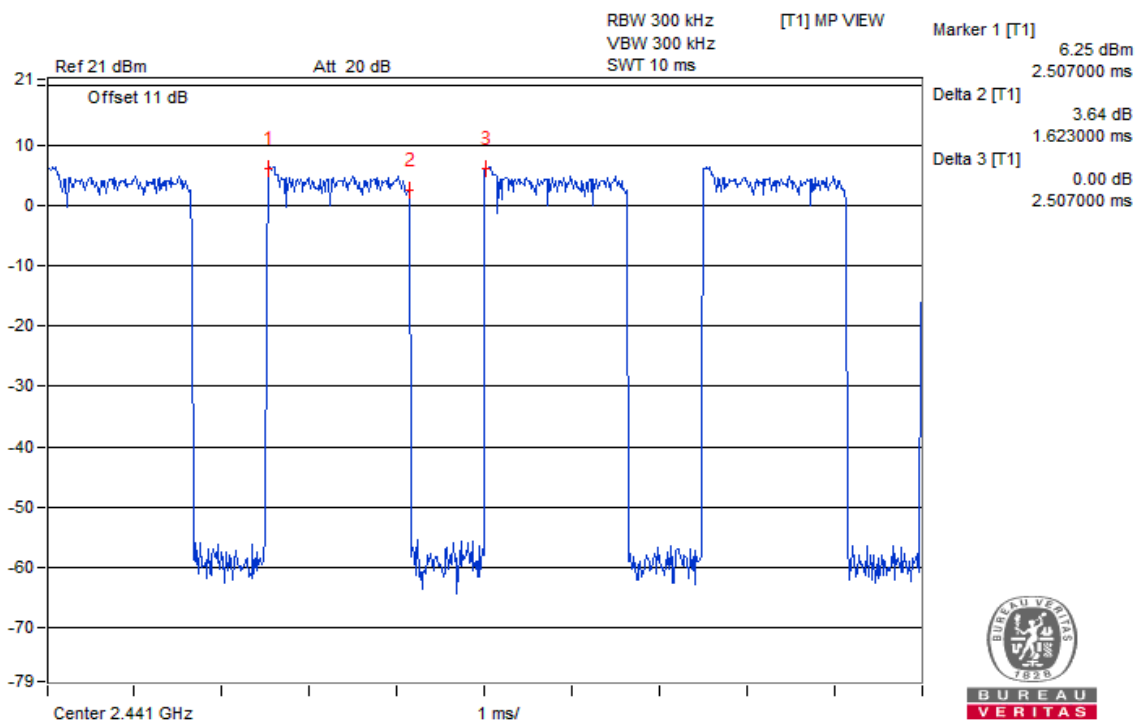
Normal Mode:

Test Condition	Mode	Spreading Rate	(Spreading Rate/79)*0.4	Duty Cycle (msec)	Result (msec)	Limit (msec)
V_{normal}	2DH1	71.20	0.360	0.147	52.920	400
	2DH3	71.20	0.360	0.647	232.920	400
	2DH5	71.20	0.360	0.569	204.840	400
V_{max.}	2DH1	71.60	0.362	0.147	53.214	400
	2DH3	71.60	0.362	0.647	234.214	400
	2DH5	71.60	0.362	0.565	204.530	400
V_{min.}	2DH1	71.40	0.361	0.144	51.984	400
	2DH3	71.40	0.361	0.647	233.567	400
	2DH5	71.40	0.361	0.569	205.409	400

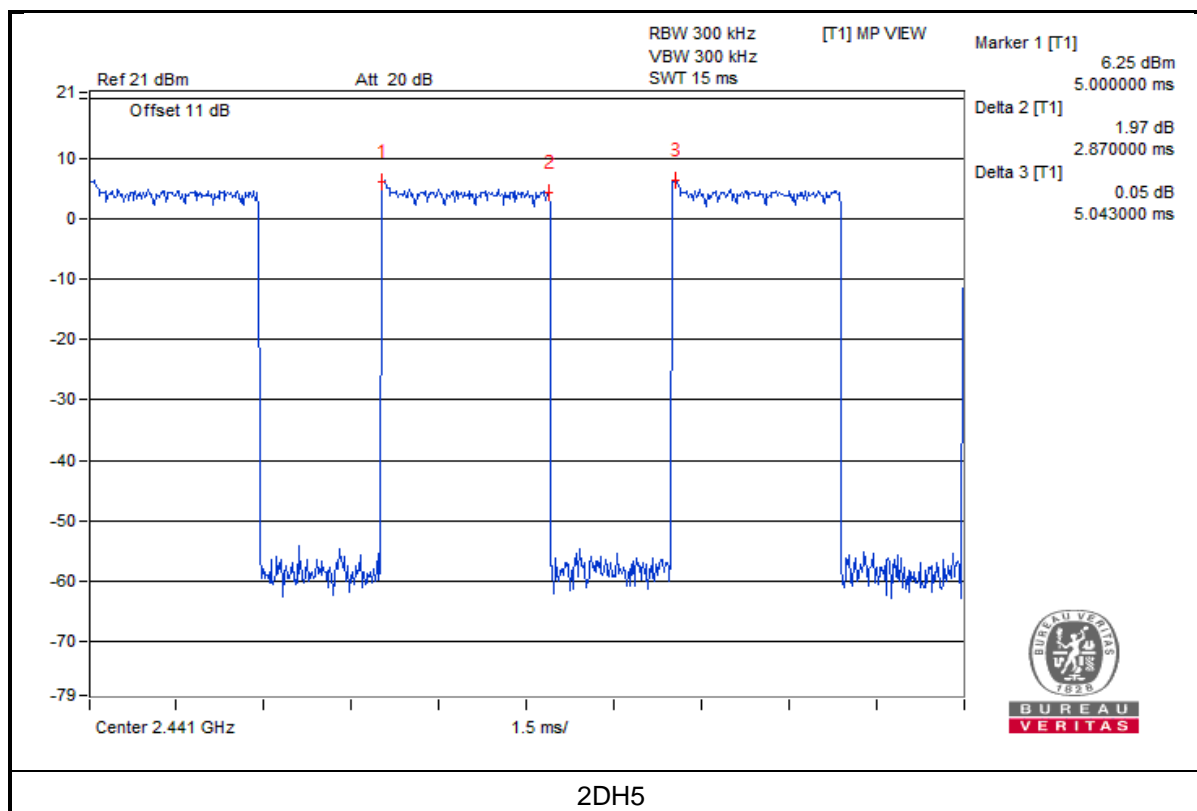
V_{normal}



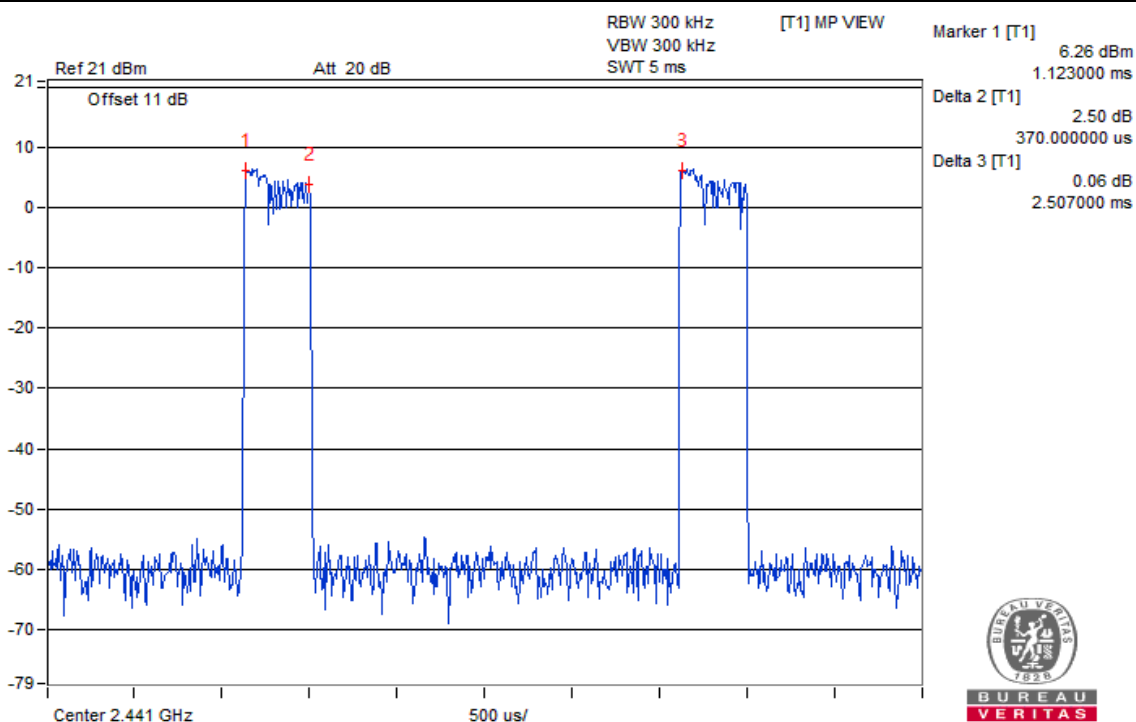
2DH1



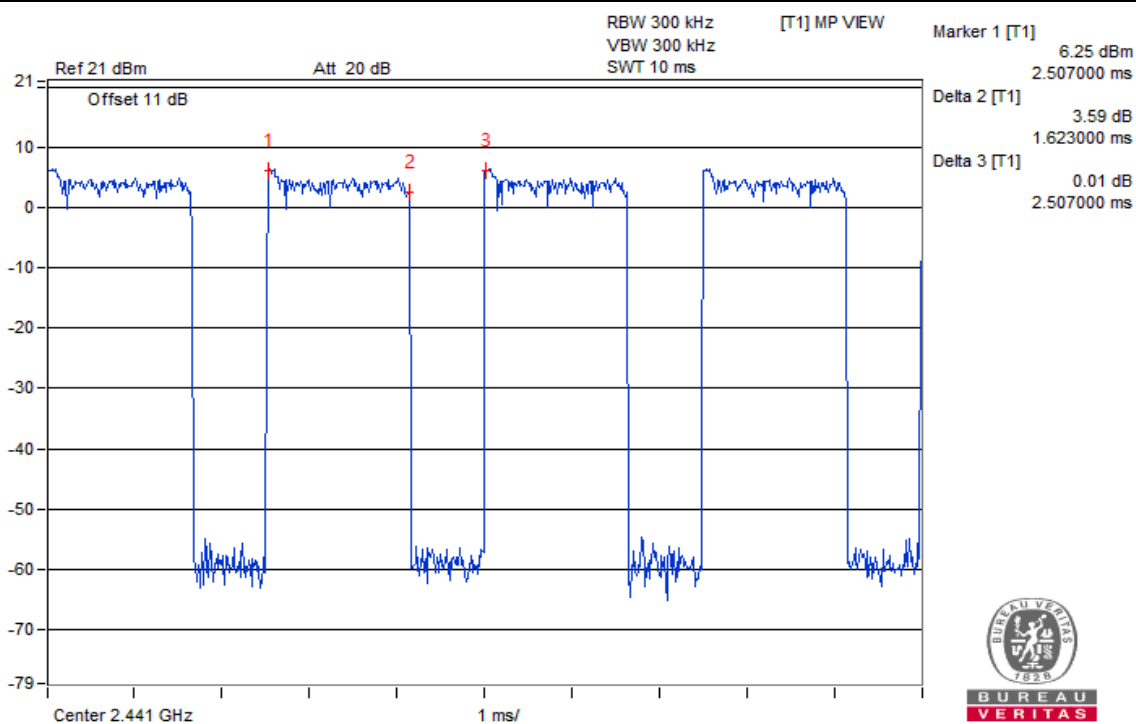
2DH3



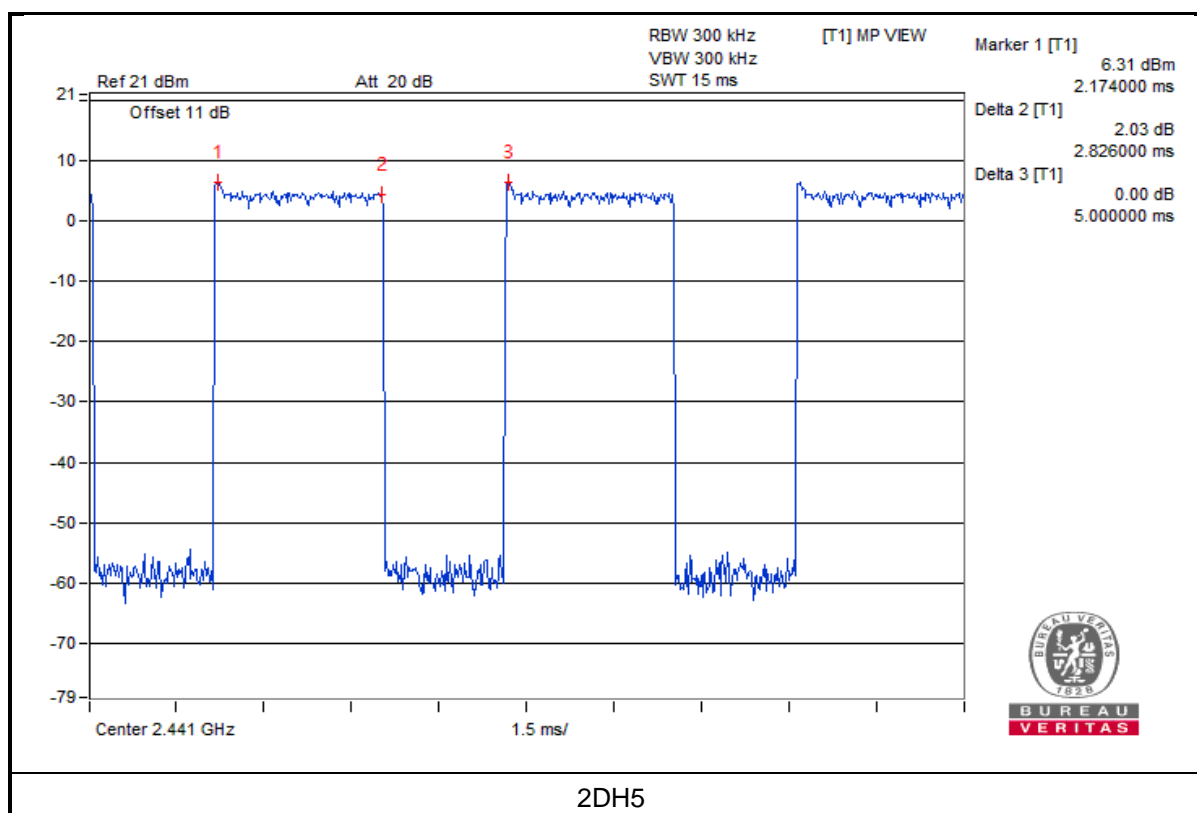
V_{max}.



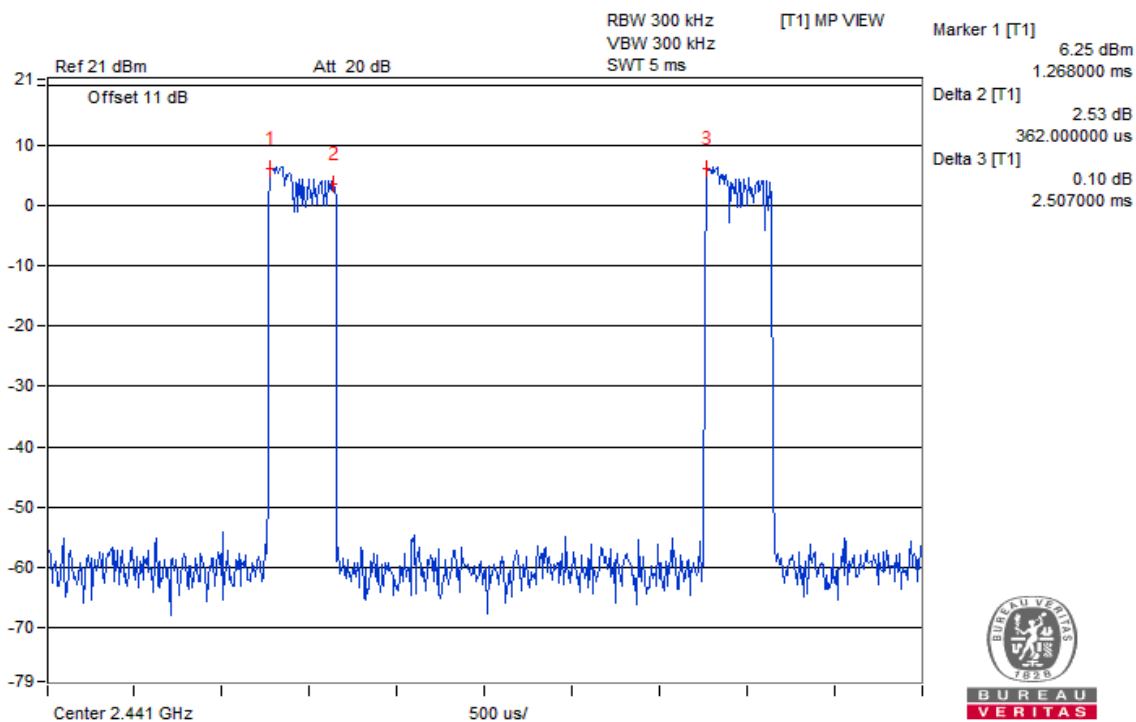
2DH1



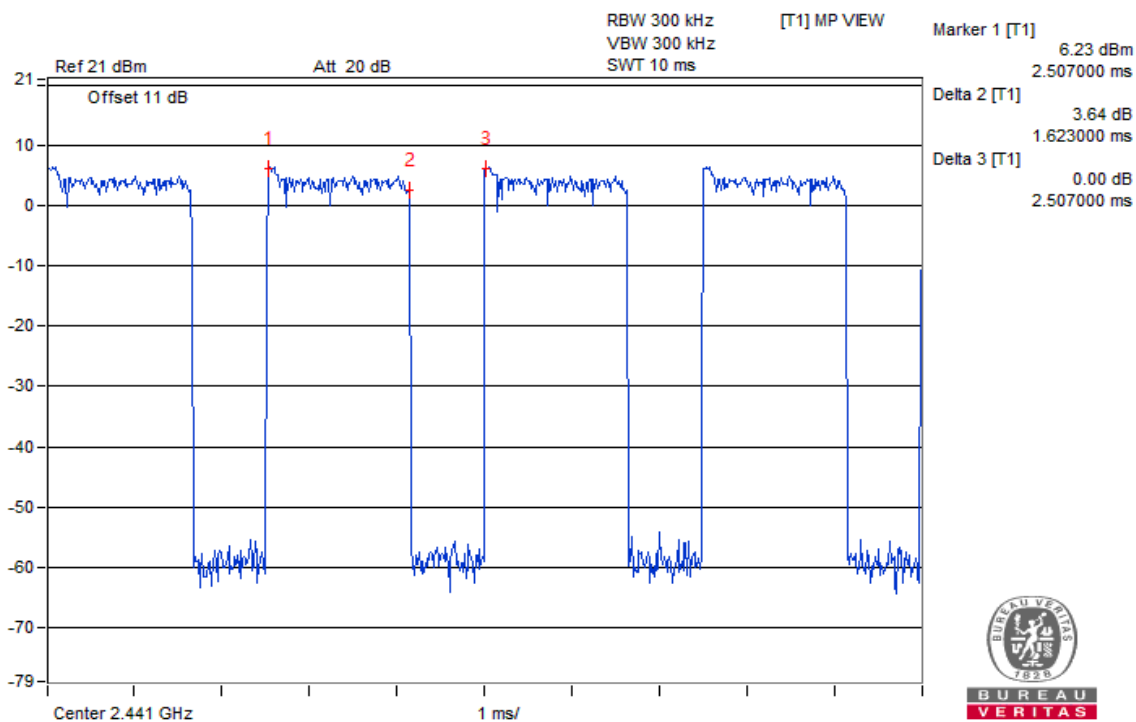
2DH3



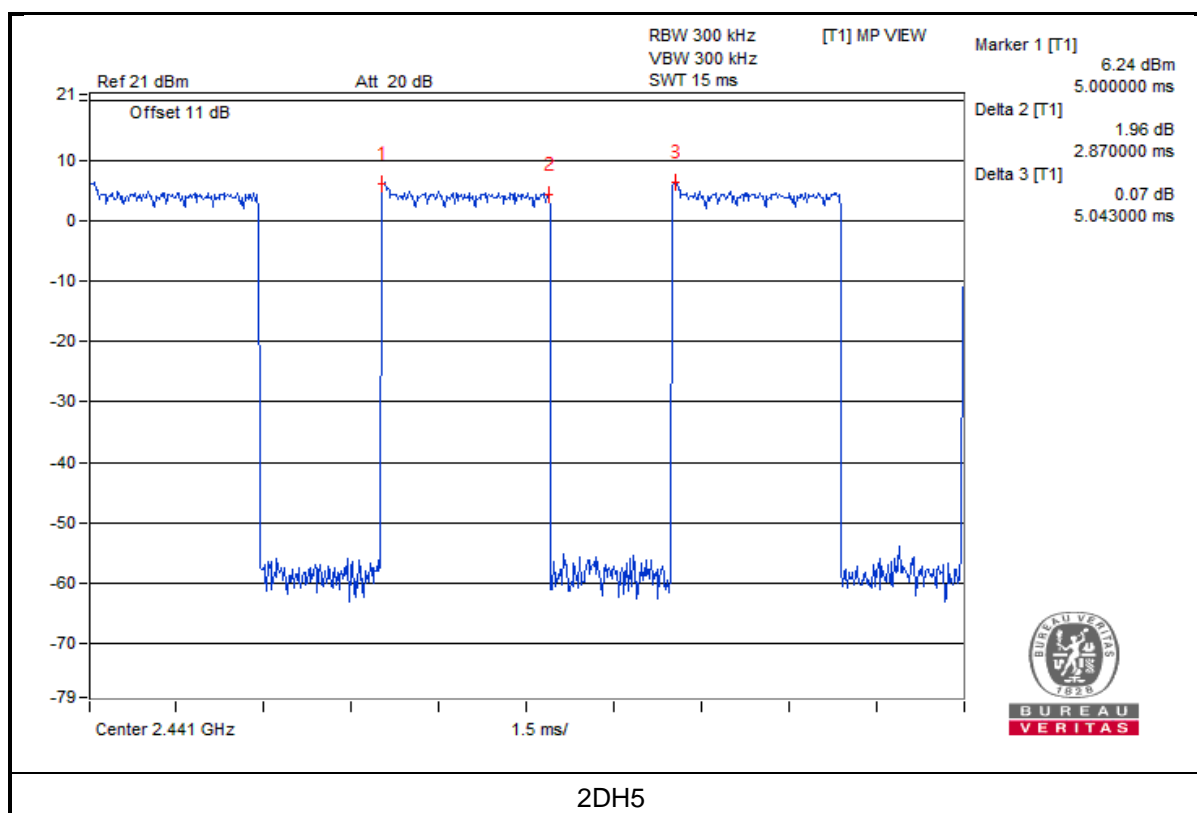
V_{min}.



2DH1



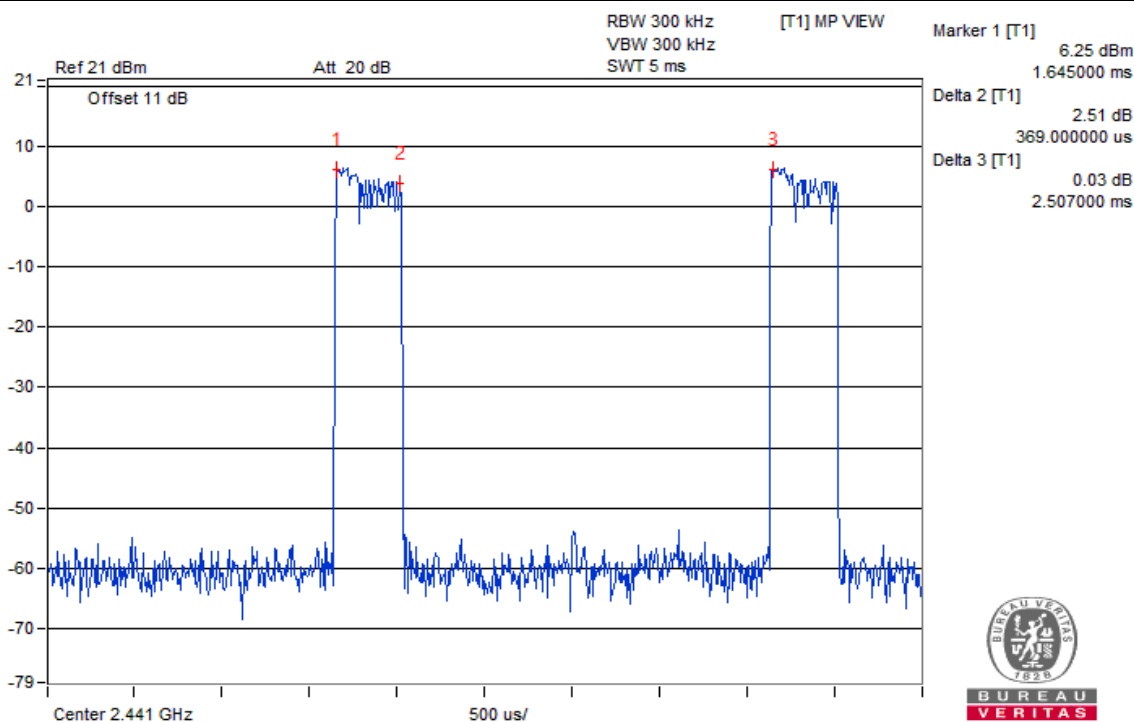
2DH3



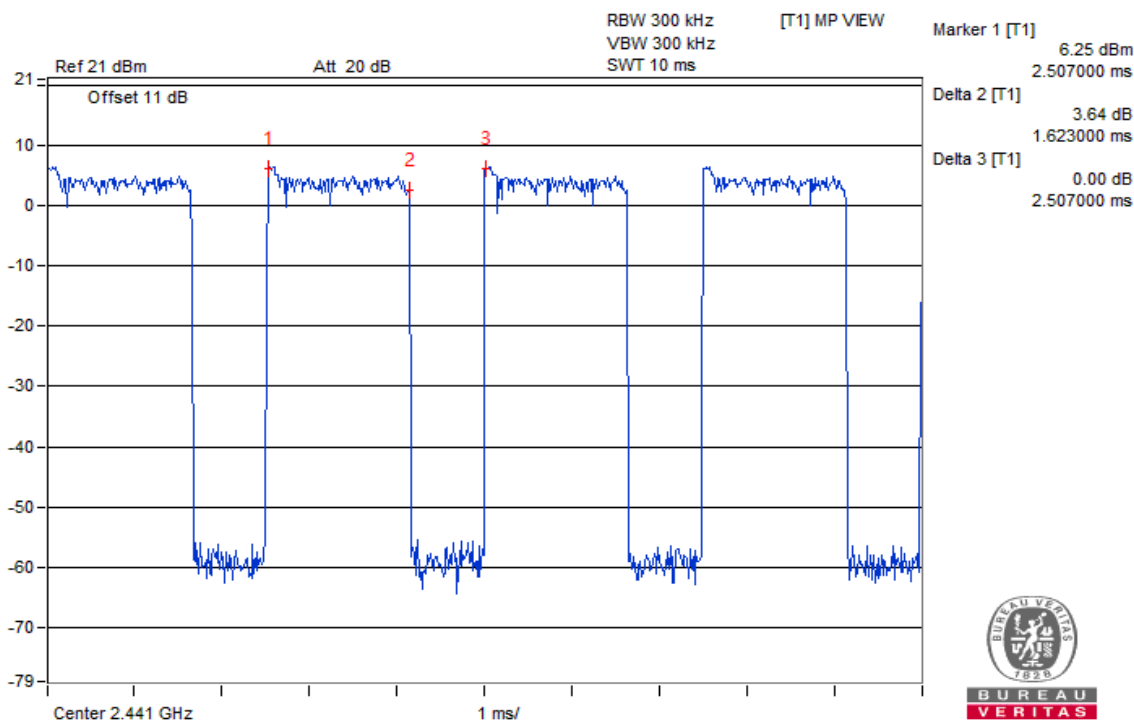
AFH Mode:

Test Condition	Mode	Spreading Rate	(Spreading Rate/20)*0.4	Duty Cycle (msec)	Result (msec)	Limit (msec)
V_{normal}	2DH1	18.27	0.365	0.147	53.655	400
	2DH3	18.27	0.365	0.647	236.155	400
	2DH5	18.27	0.365	0.569	207.685	400
V_{max.}	2DH1	18.34	0.366	0.147	53.802	400
	2DH3	18.34	0.366	0.647	236.802	400
	2DH5	18.34	0.366	0.565	206.790	400
V_{min.}	2DH1	18.34	0.366	0.144	52.704	400
	2DH3	18.34	0.366	0.647	236.802	400
	2DH5	18.34	0.366	0.569	208.254	400

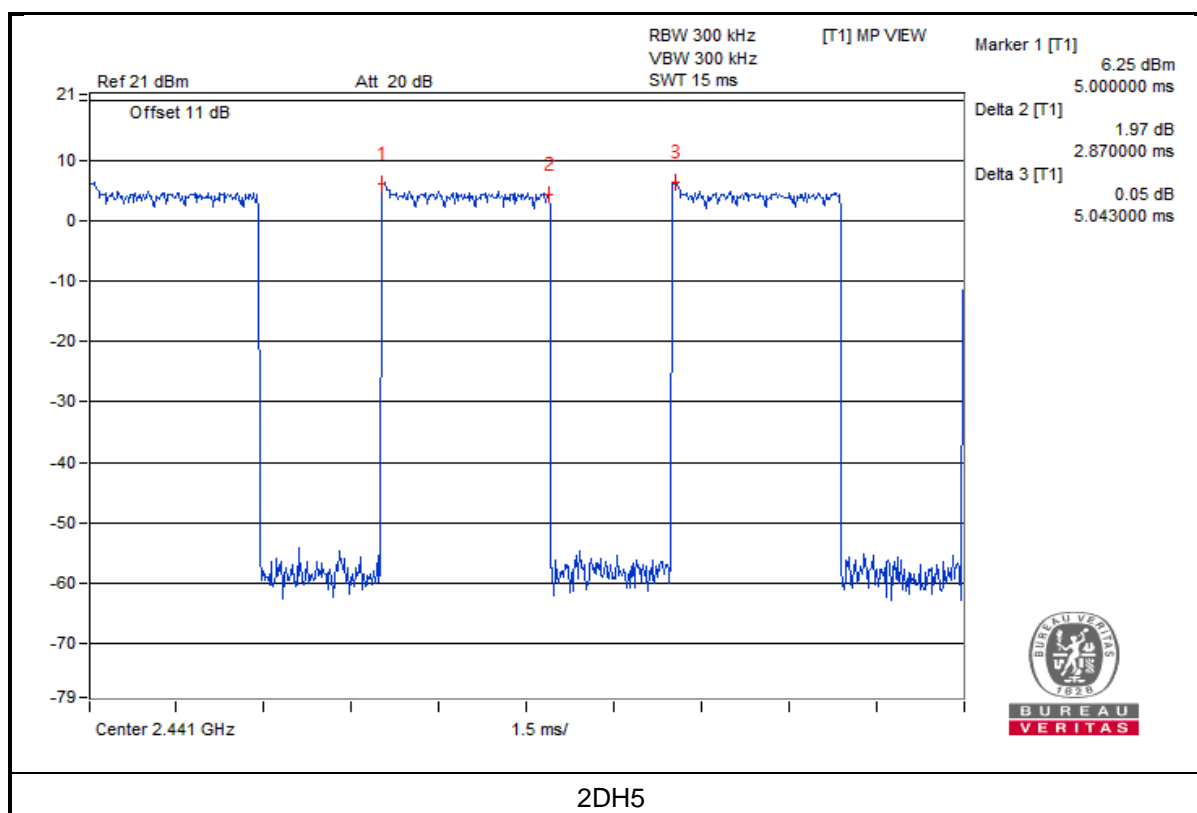
V_{normal}



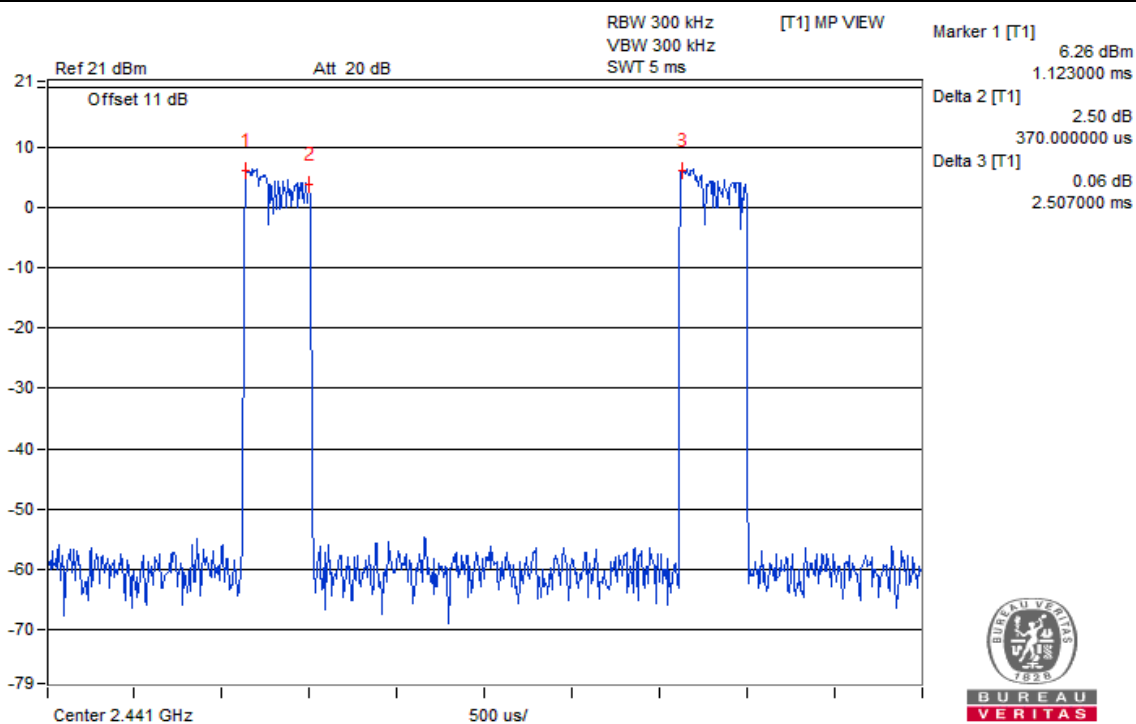
2DH1



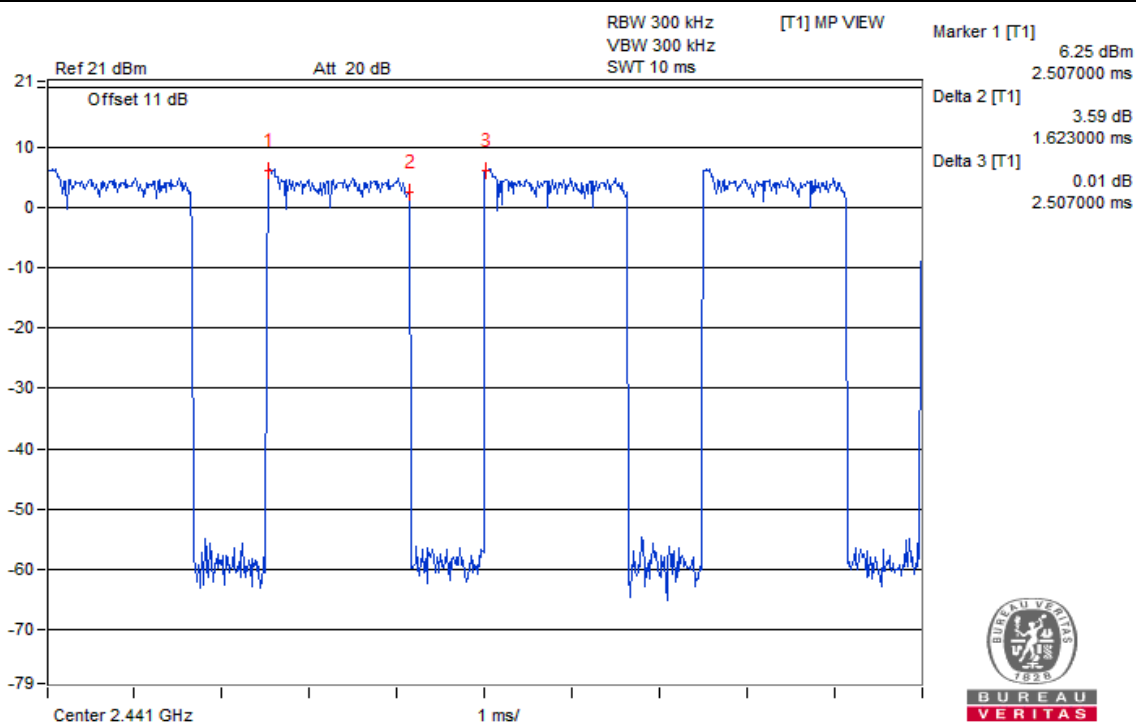
2DH3



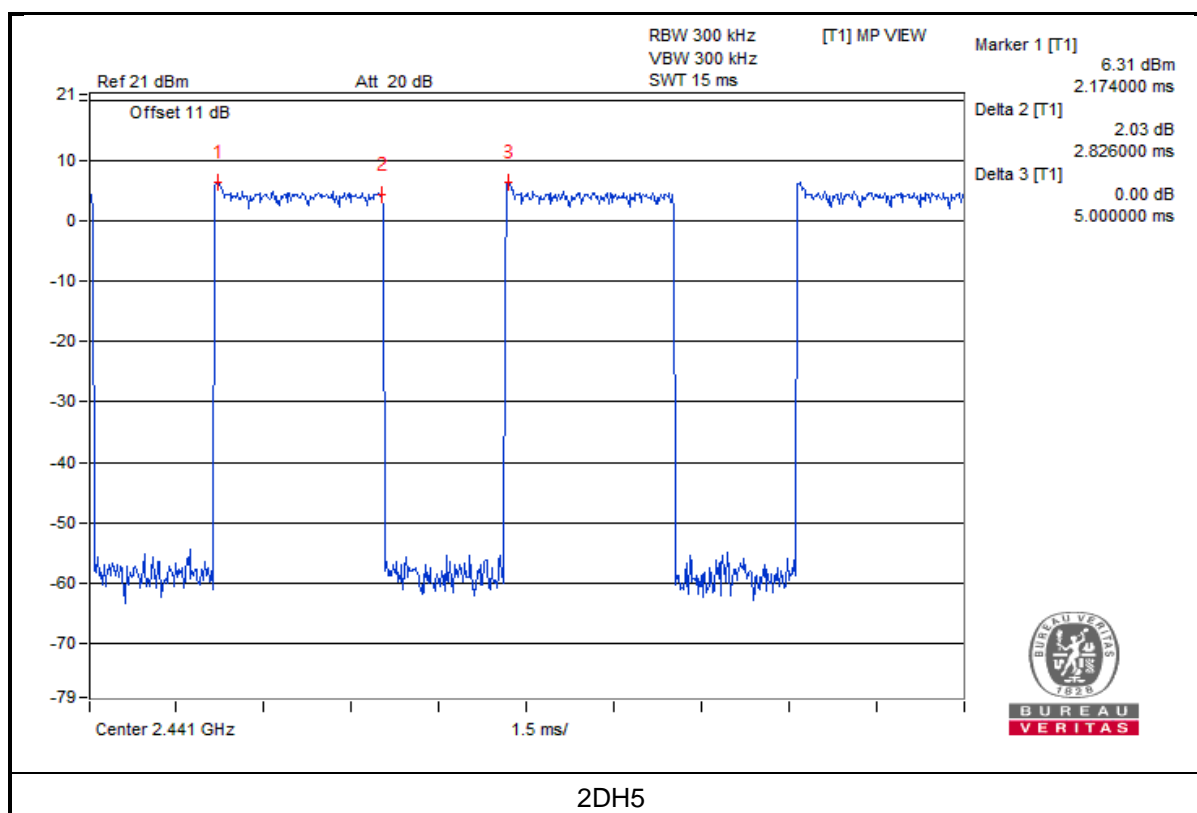
V_{max}.



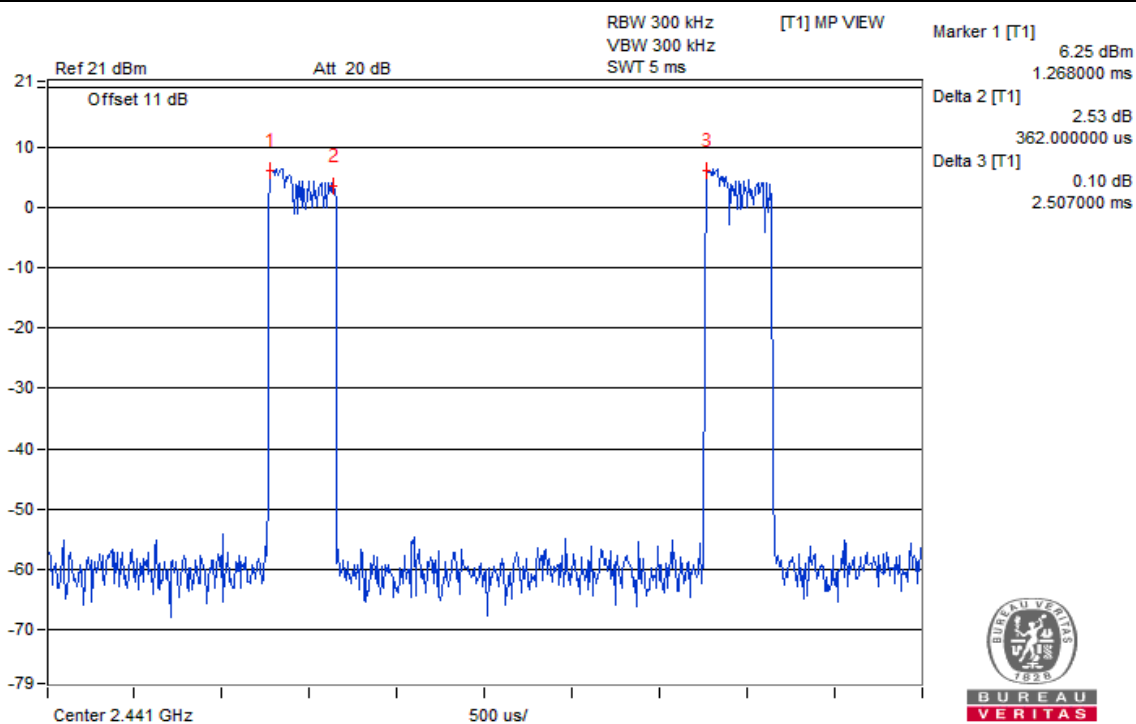
2DH1



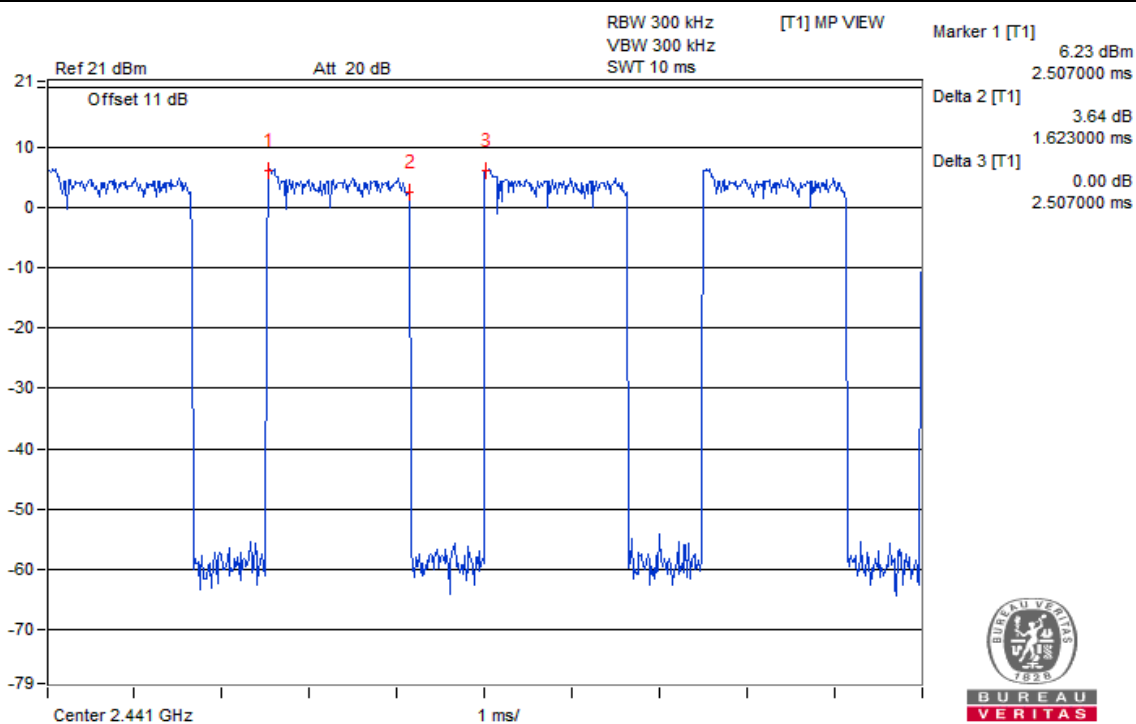
2DH3



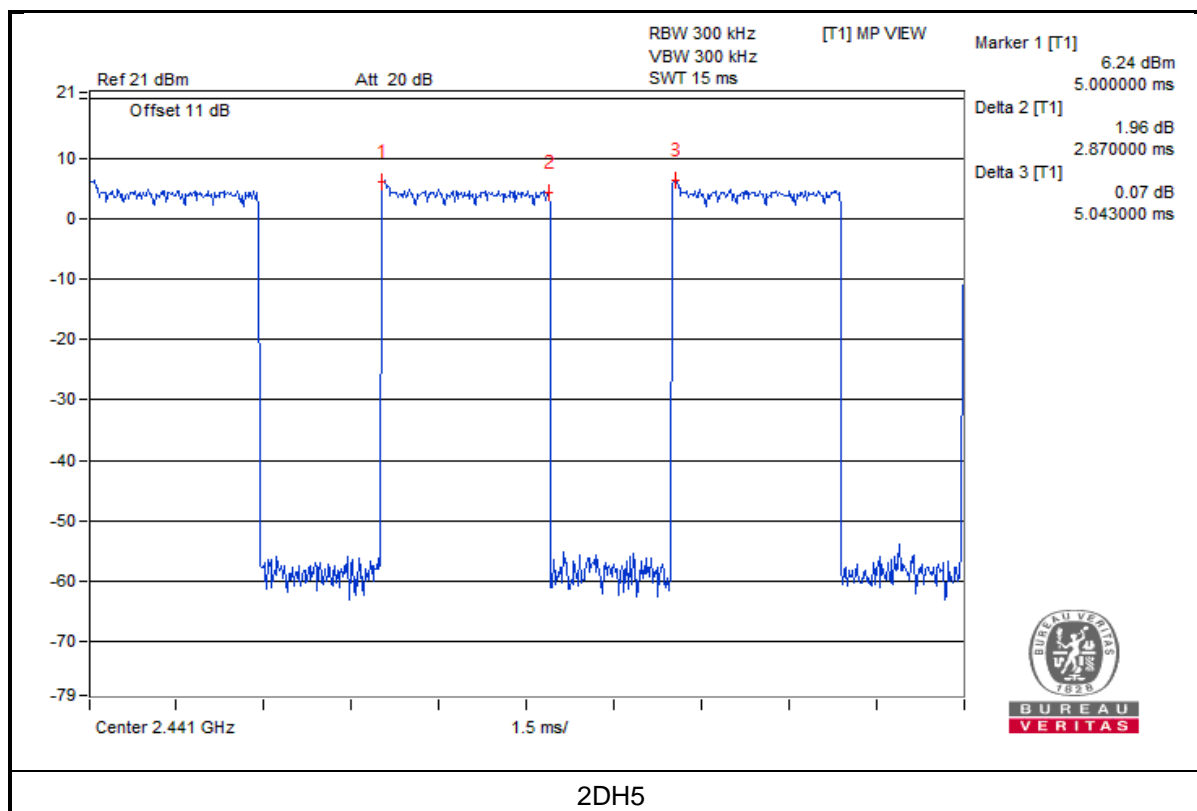
V_{min}.



2DH1



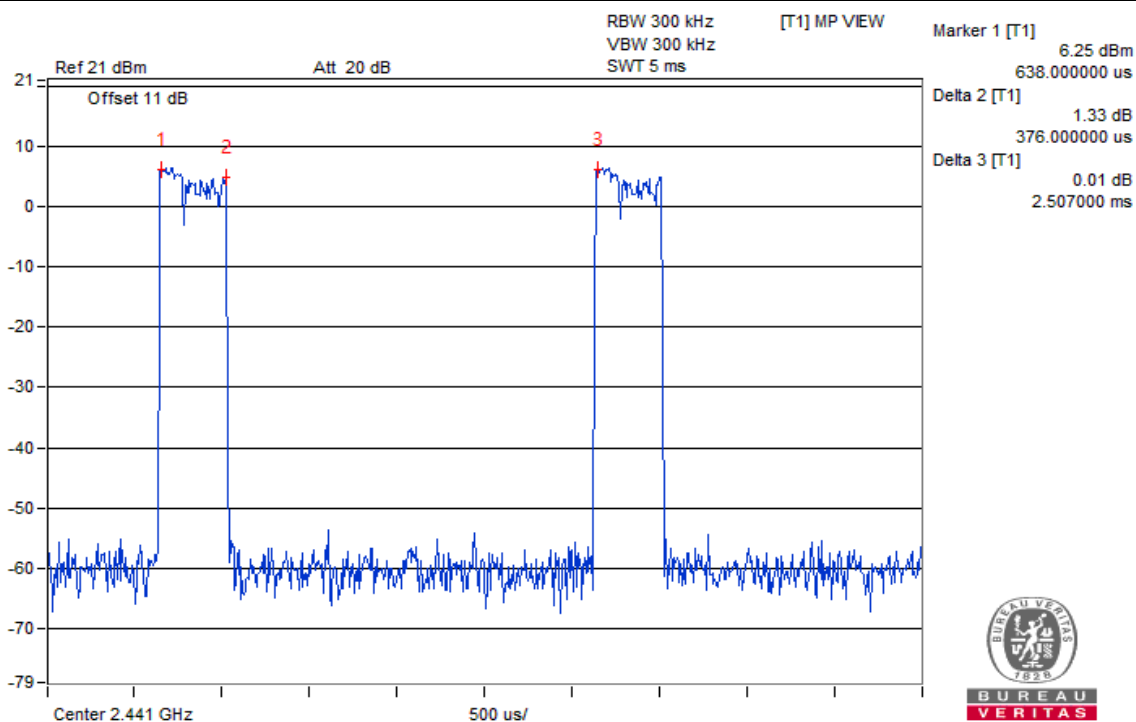
2DH3



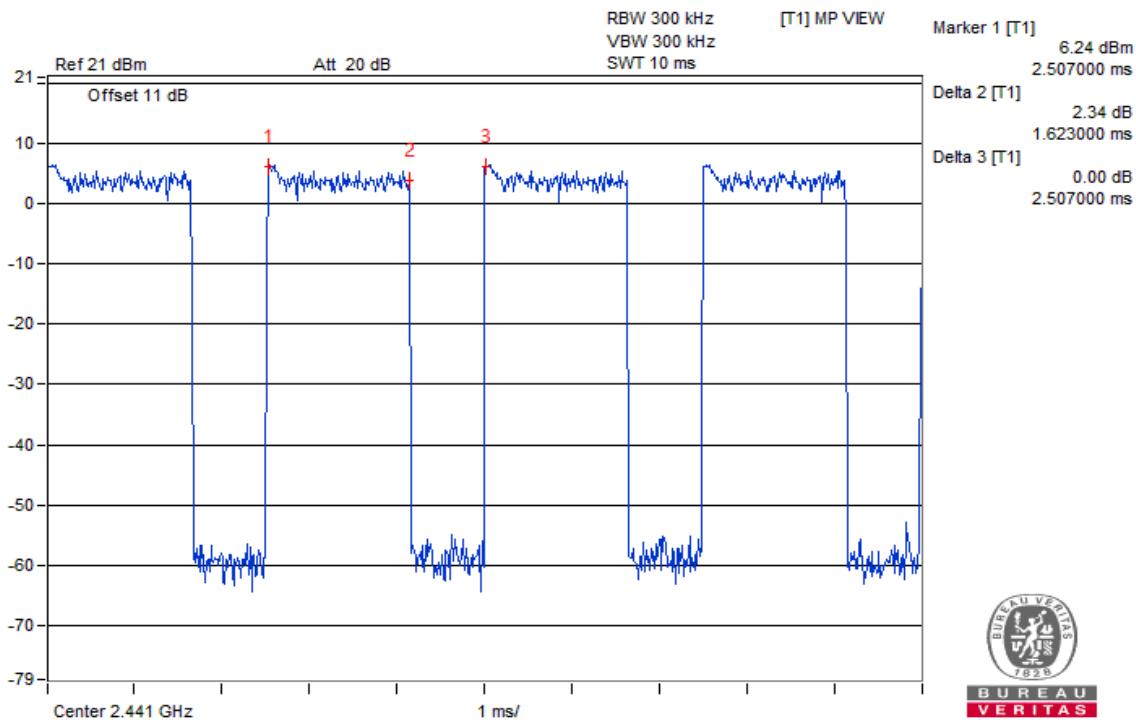
Modulation: 8DPSK
Normal Mode:

Test Condition	Mode	Spreading Rate	(Spreading Rate/79)*0.4	Duty Cycle (msec)	Result (msec)	Limit (msec)
V_{normal}	3DH1	71.40	0.361	0.149	53.789	400
	3DH3	71.40	0.361	0.647	233.567	400
	3DH5	71.40	0.361	0.573	206.853	400
V_{max.}	3DH1	71.60	0.362	0.147	53.214	400
	3DH3	71.60	0.362	0.647	234.214	400
	3DH5	71.60	0.362	0.573	207.426	400
V_{min.}	3DH1	71.20	0.360	0.147	52.920	400
	3DH3	71.20	0.360	0.647	232.920	400
	3DH5	71.20	0.360	0.573	206.280	400

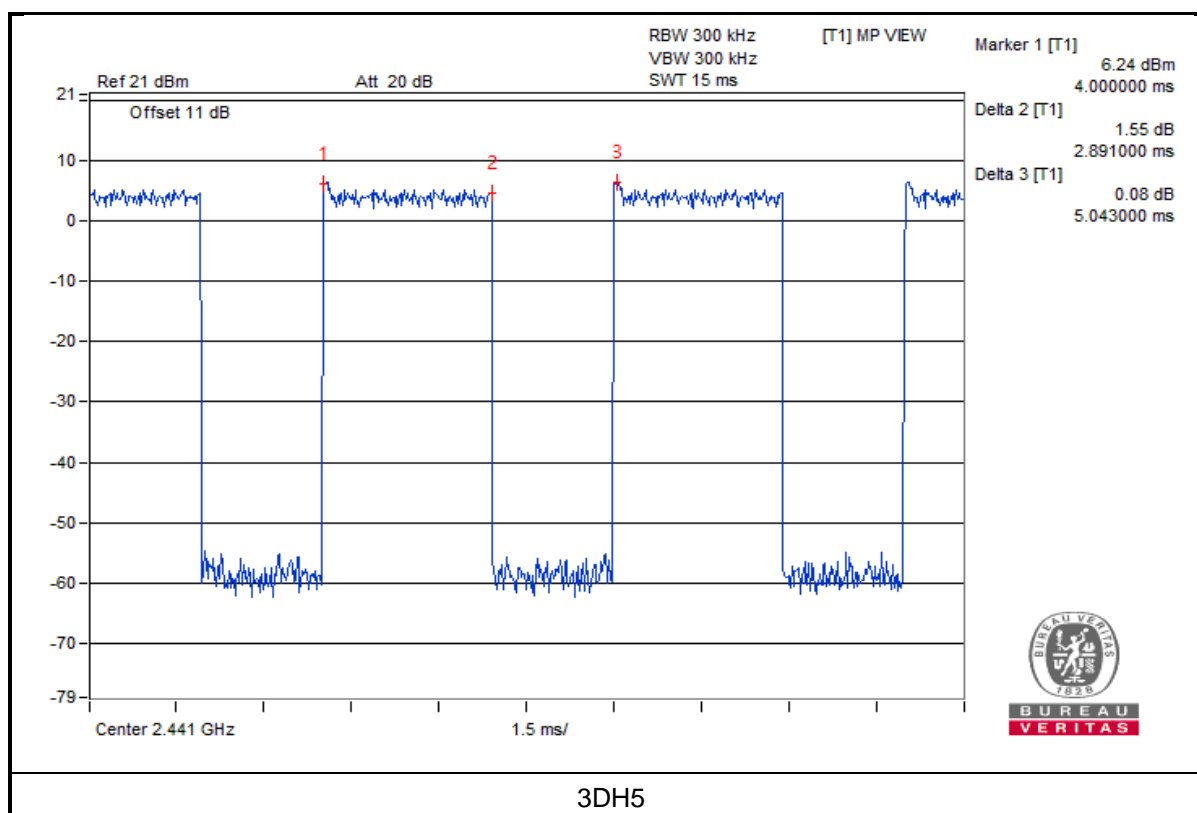
V_{normal}



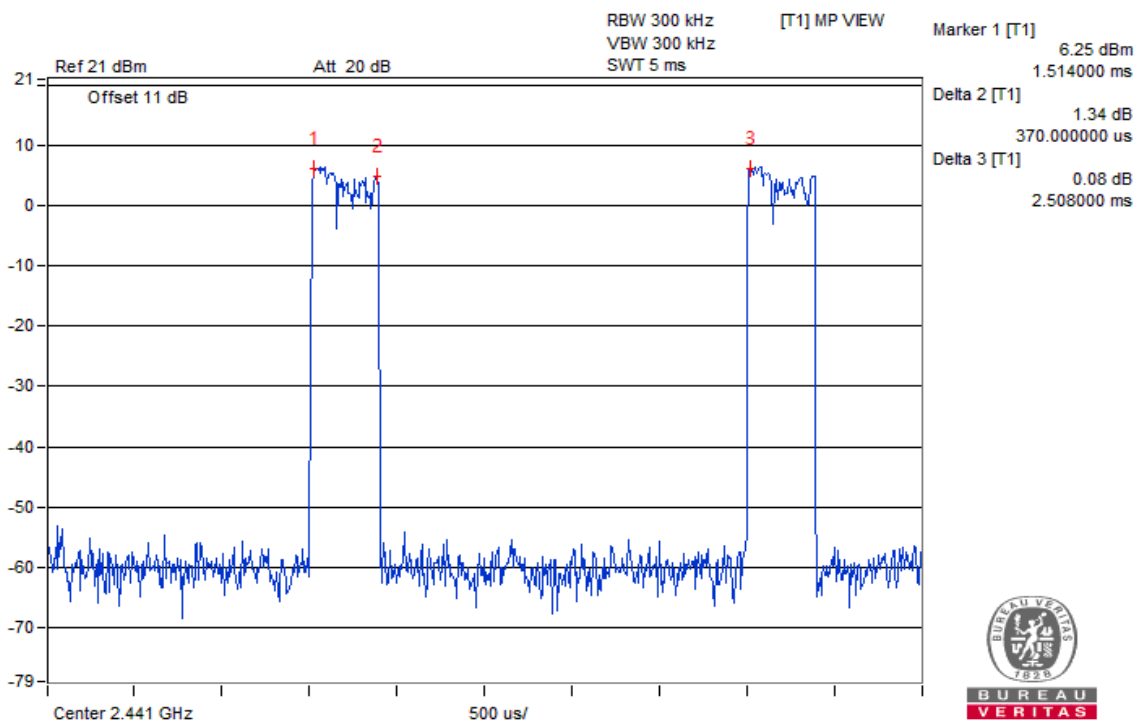
3DH1



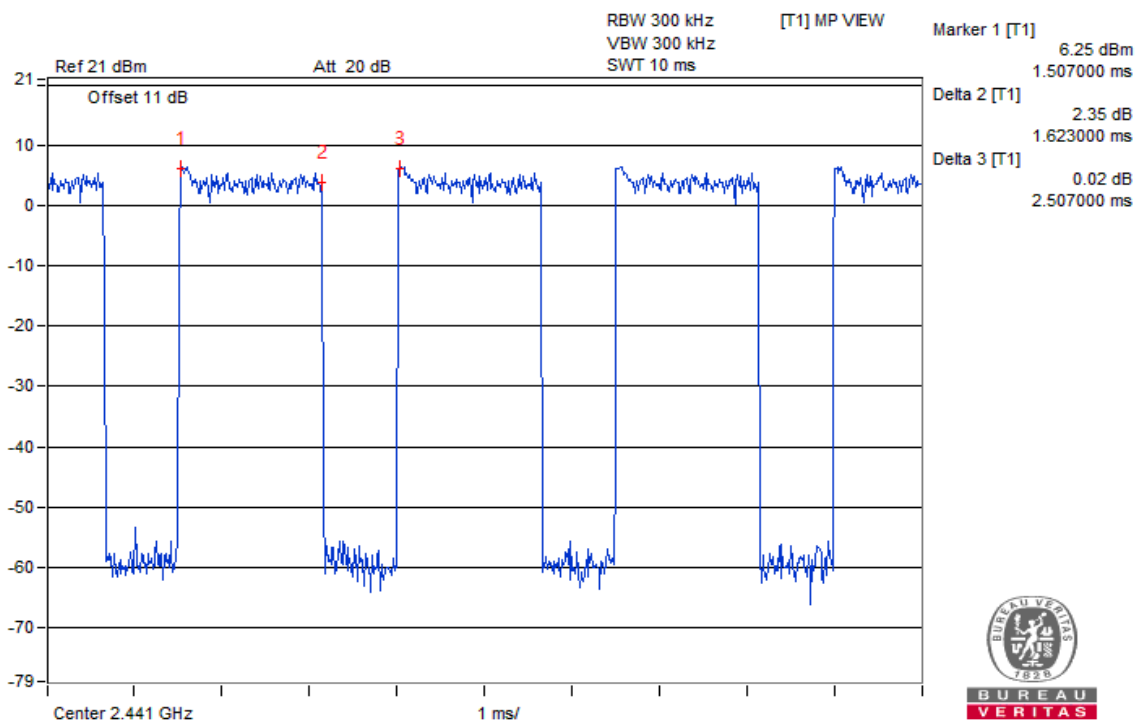
3DH3



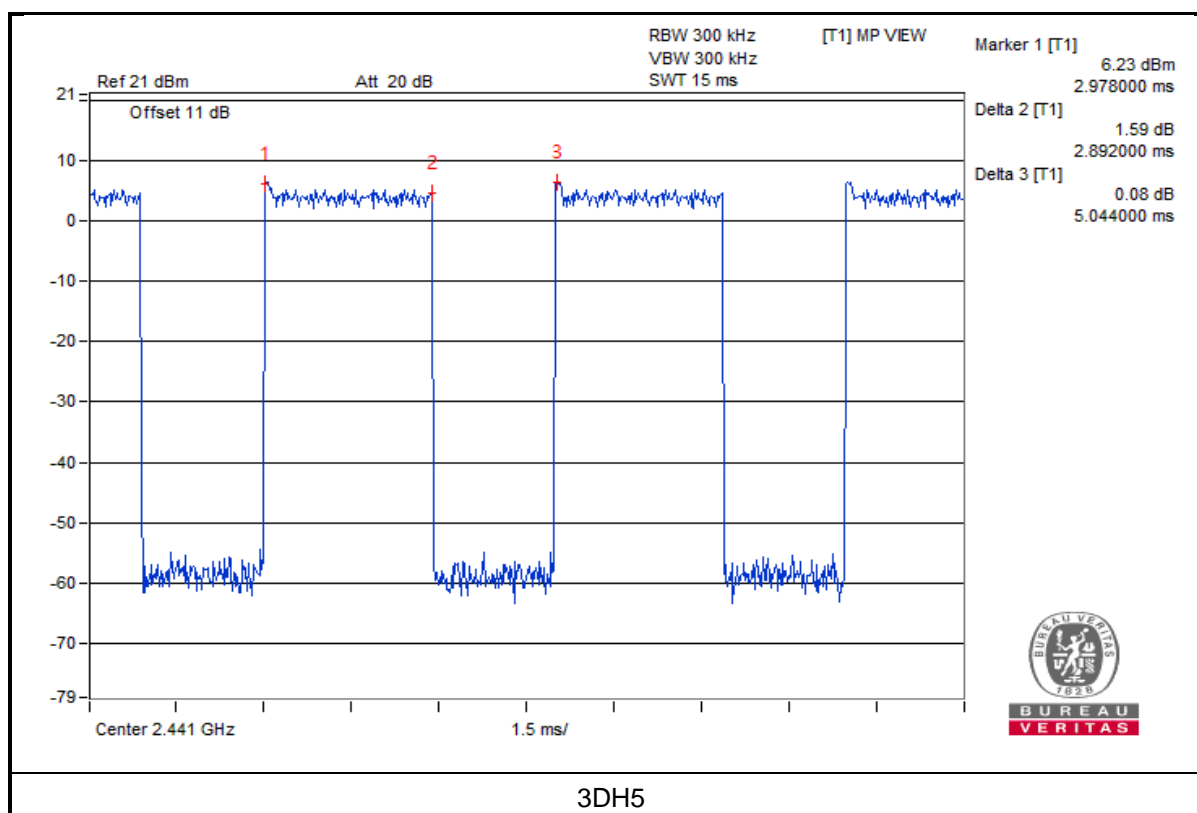
V_{max}.



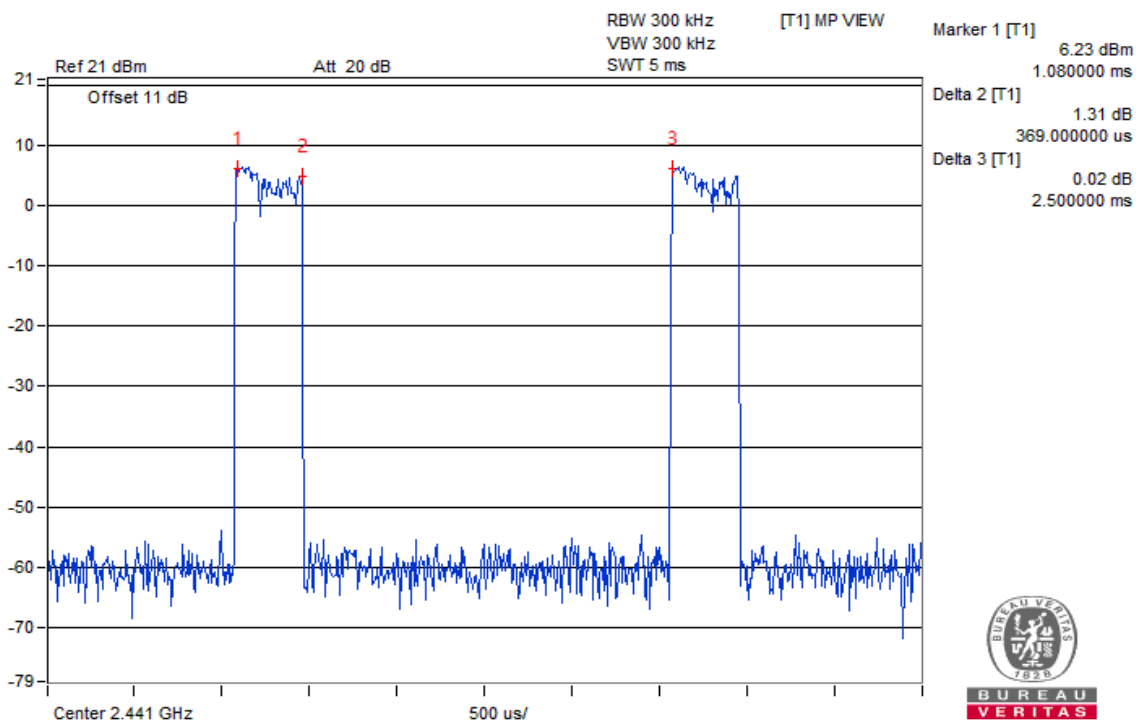
3DH1



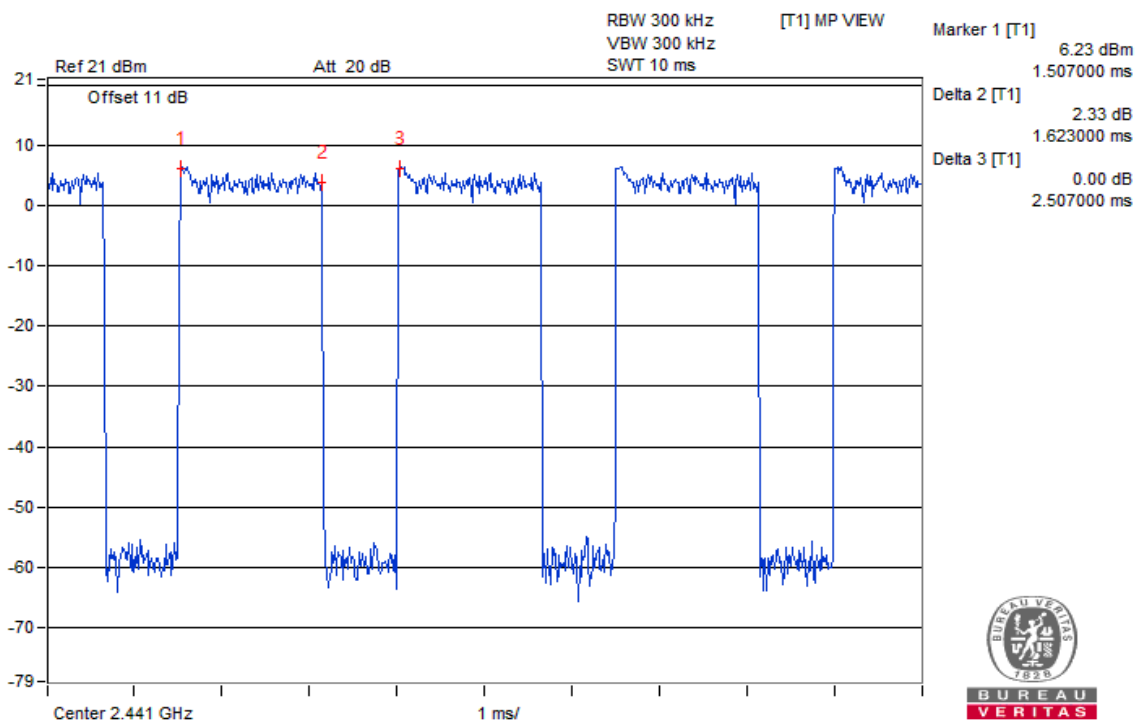
3DH3



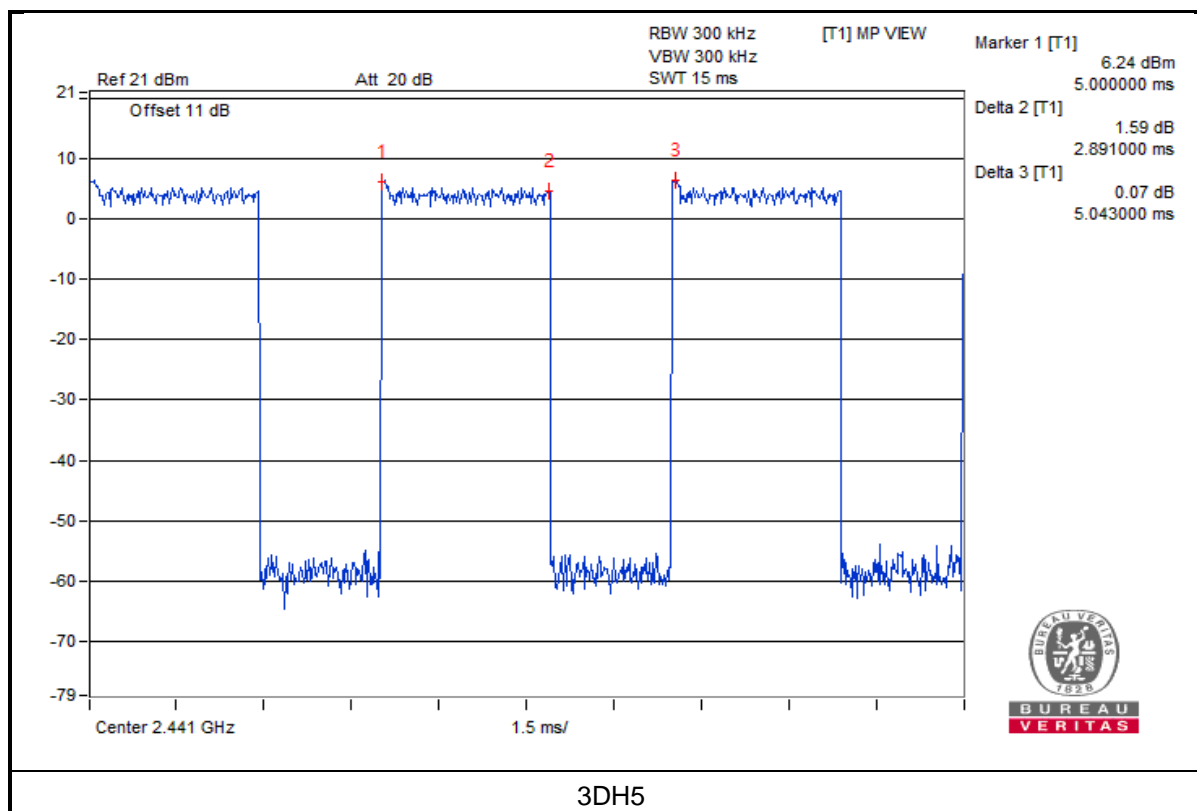
V_{min}.



3DH1



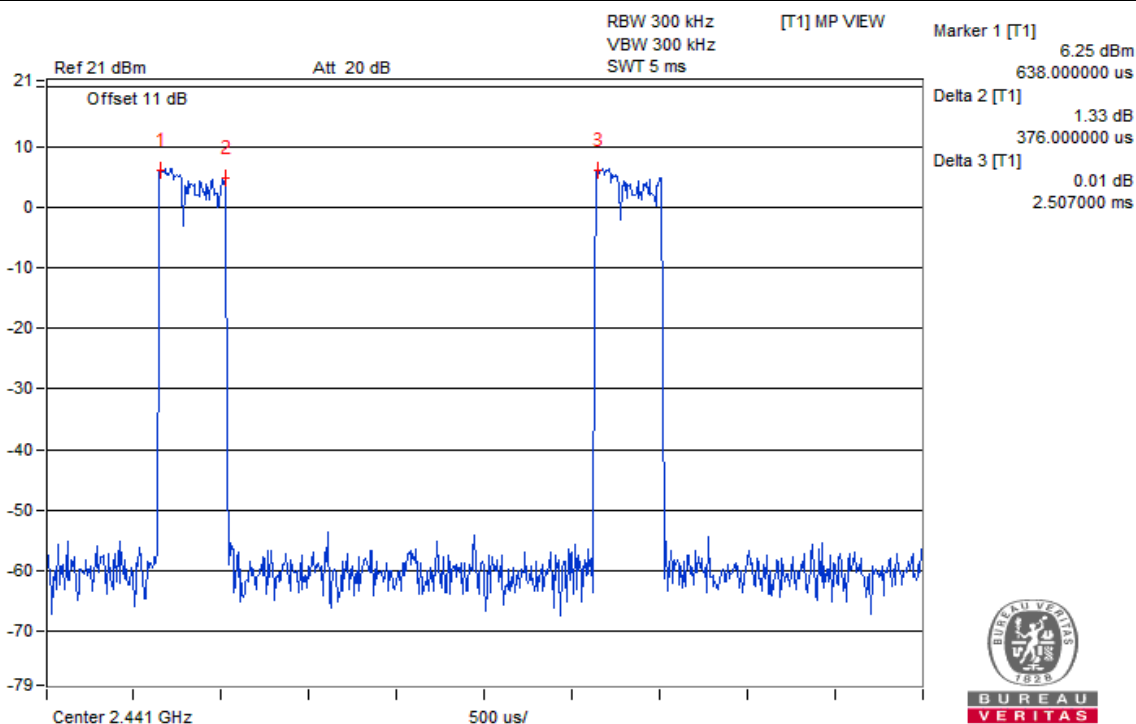
3DH3



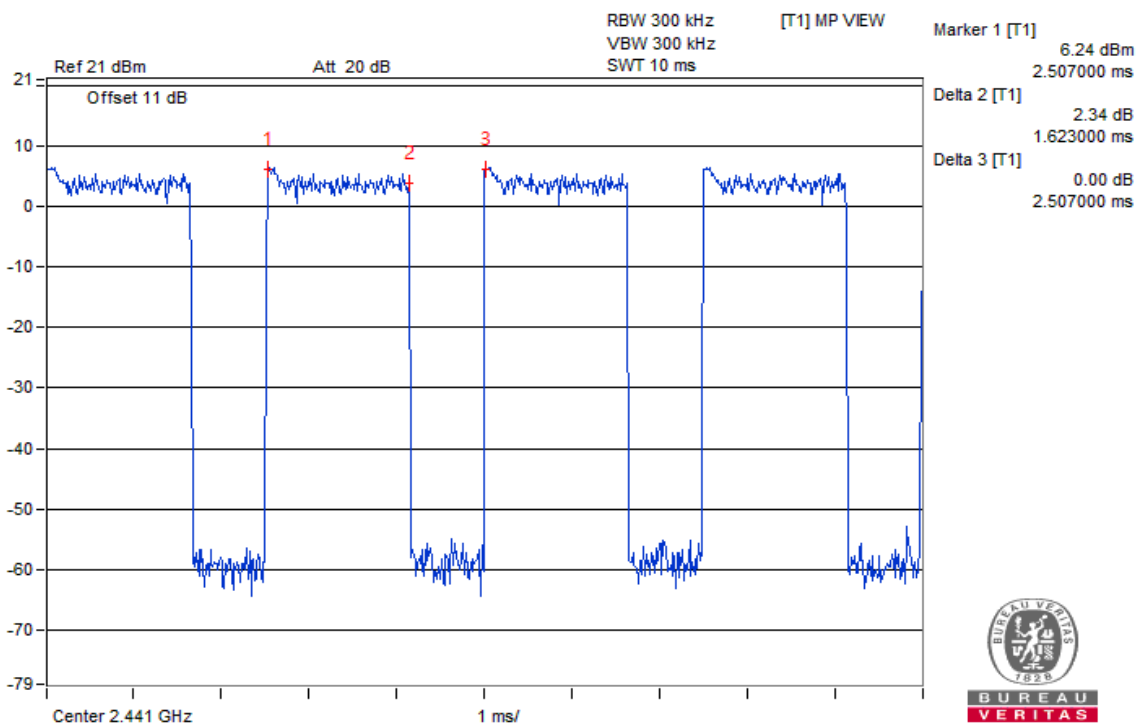
AFH Mode:

Test Condition	Mode	Spreading Rate	(Spreading Rate/20)*0.4	Duty Cycle (msec)	Result (msec)	Limit (msec)
V_{normal}	3DH1	18.34	0.366	0.149	54.534	400
	3DH3	18.34	0.366	0.647	236.802	400
	3DH5	18.34	0.366	0.573	209.718	400
V_{max.}	3DH1	18.34	0.366	0.147	53.802	400
	3DH3	18.34	0.366	0.647	236.802	400
	3DH5	18.34	0.366	0.573	209.718	400
V_{min.}	3DH1	18.34	0.366	0.147	53.802	400
	3DH3	18.34	0.366	0.647	236.802	400
	3DH5	18.34	0.366	0.573	209.718	400

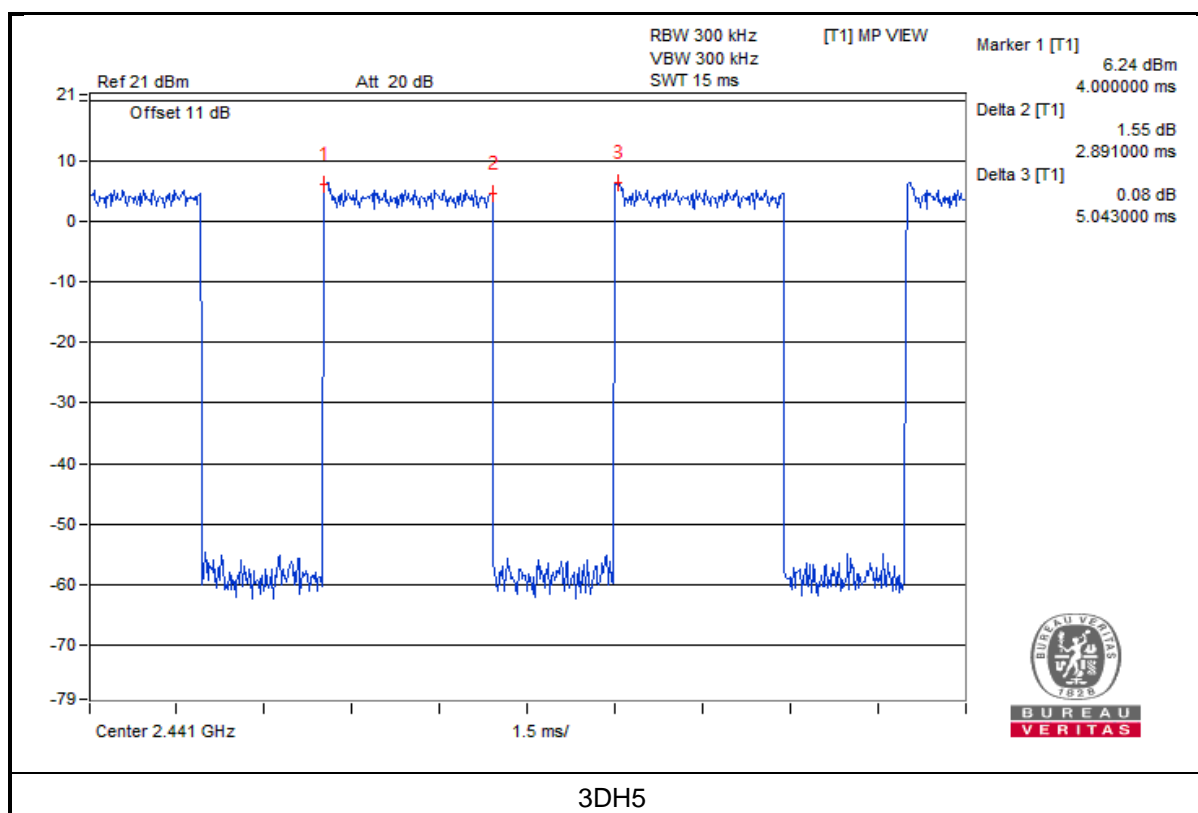
V_{normal}



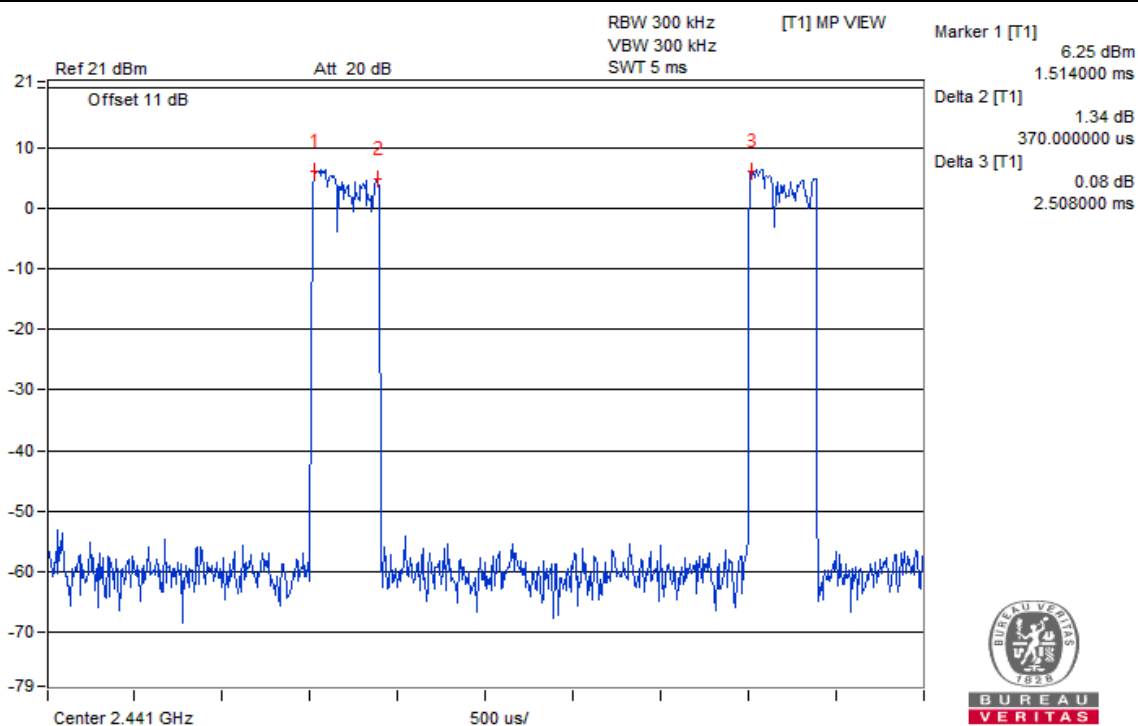
3DH1



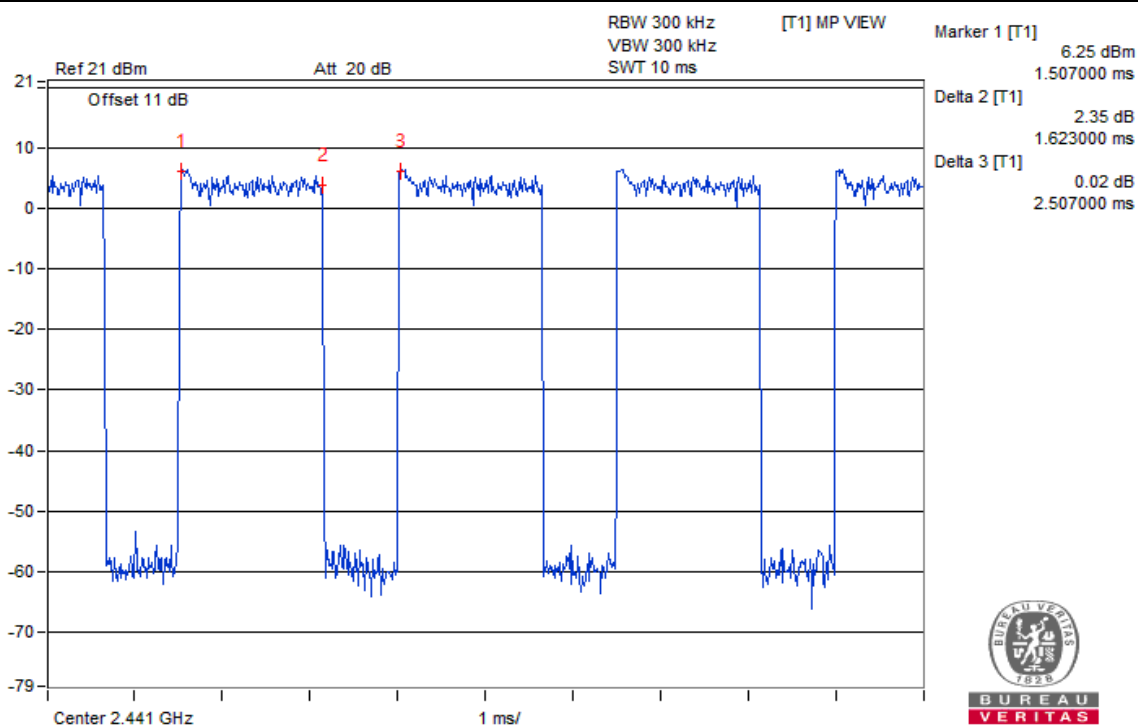
3DH3



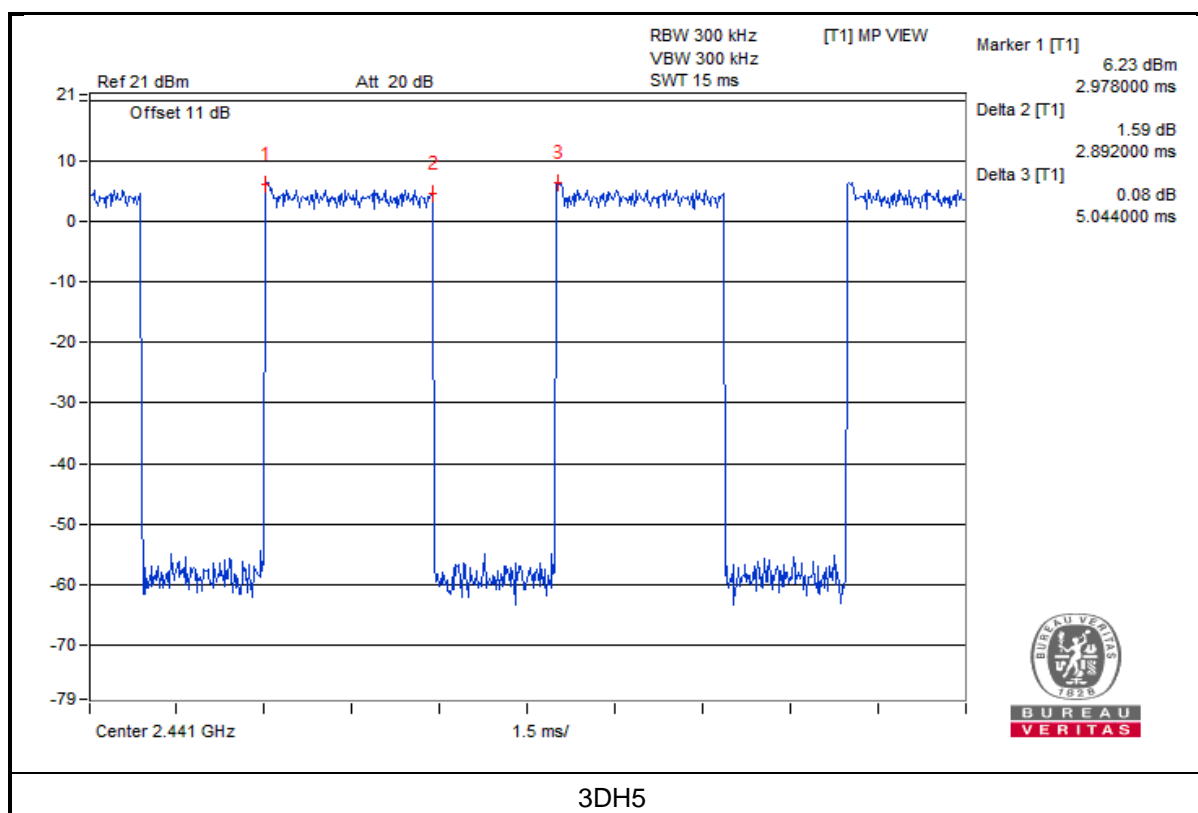
V_{max}.



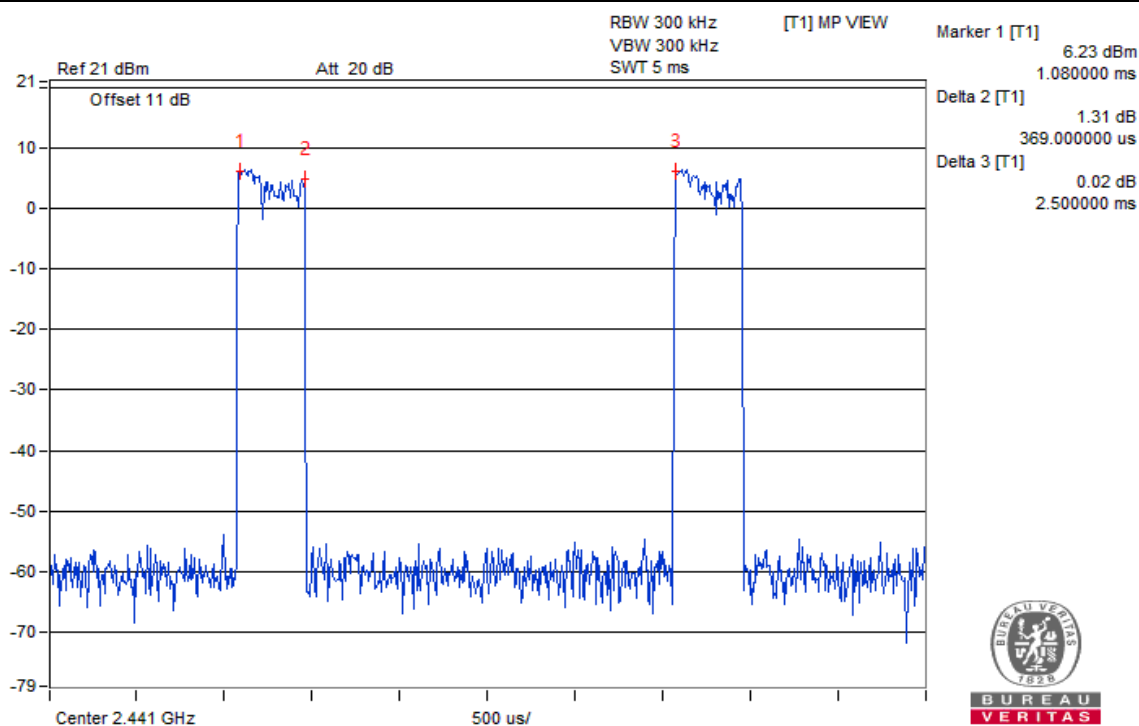
3DH1



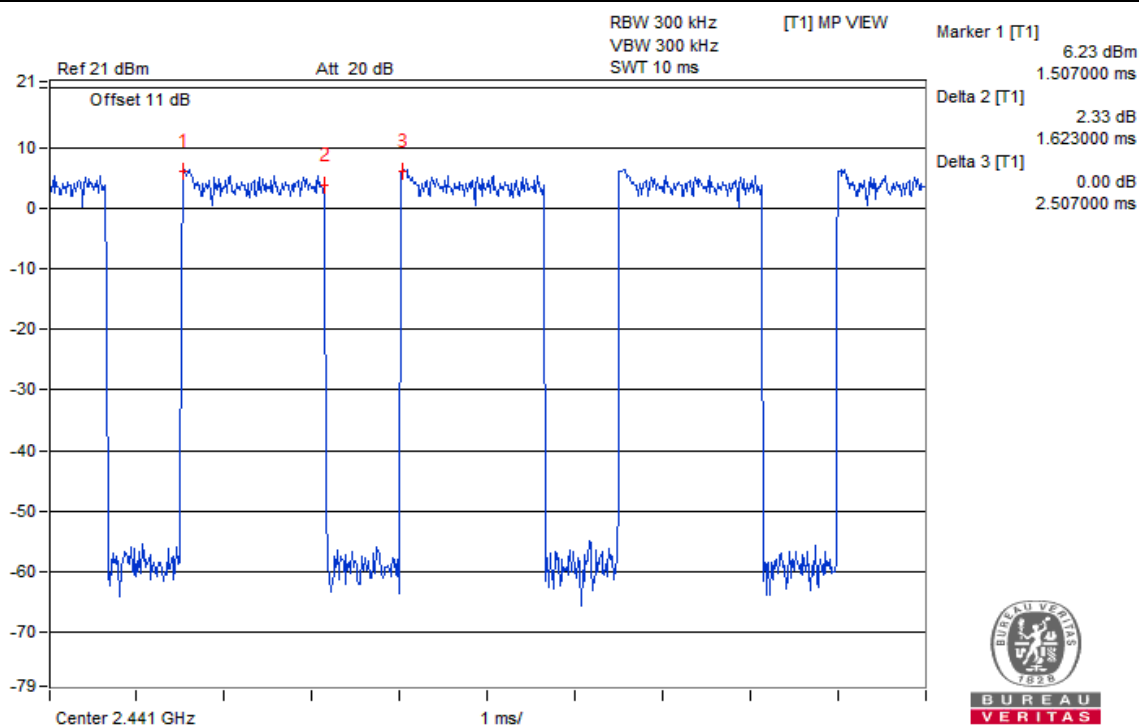
3DH3



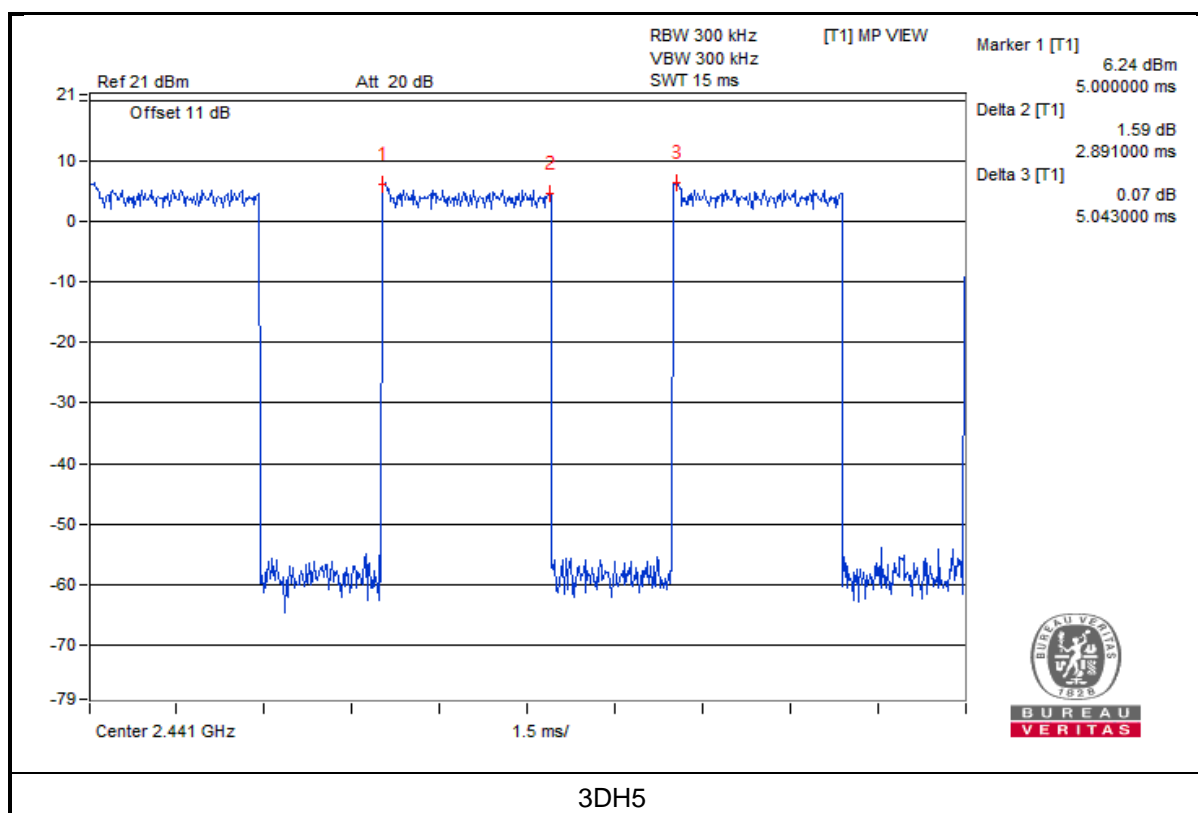
V_{min}.



3DH1



3DH3

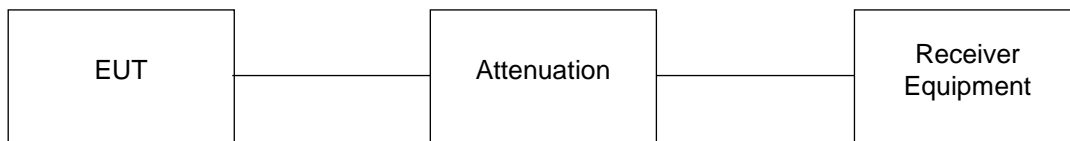


4.8 Interference Prevention Function

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, 60% RH
Link Mode	Test Result
BT-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 accredited and approved according to ISO/IEC 17025.

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

Lin Kou EMC/RF Lab

Tel: 886-2-26052180

Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab

Tel: 886-3-6668565

Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety Lab

Tel: 886-3-3183232

Fax: 886-3-3270892

Emai

Web Site: www.bureauveritas-adt.com

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

--- END ---