

Radio Test Report

Report No.: RJ180109E07

Test Model: VMB3500

Received Date: Jan. 19, 2018

Test Date: Mar. 13, 2018

Issued Date: Apr. 10, 2018

Applicant: NETGEAR, Inc.

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
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Release Control Record

Issue No.	Description	Date Issued
RJ180109E07	Original release.	Apr. 10, 2018

1 Certificate of Conformity

Product: IP Camera Base Station

Brand: NETGEAR

Test Model: VMB3500

Sample Status: ENGINEERING SAMPLE

Applicant: NETGEAR, Inc.

Test Date: Mar. 13, 2018

Standards: ARIB STD-T66 (V3.7), MIC notice 88 Appendix 43

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 :

Mary Ko

Date:

Apr. 10, 2018

Mary Ko / Specialist

Approved by :

May Chen

Date:

Apr. 10, 2018

May Chen / 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)	4.8	Number of carriers within 1 MHz bandwidth in OFDM	C
--	3.2 (8)	4.3	Spreading bandwidth	C
--	3.2 (9)	4.3	Spreading factor	C
--	3.2 (11)	--	Frequency retention time (FH employed)	NA
--	3.4.1(1)	4.7	Interference Prevention Function	C
--	3.4.1(3)	--	Carrier Sense Capability	NA
Note: C = Conform NC = Not Conform NT = Not Tested NA = Not Applicable				

2.1 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

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	IP Camera Base Station
Brand	NETGEAR
Test Model	VMB3500
Status of EUT	ENGINEERING SAMPLE
Nominal Voltage	12Vdc from power adapter
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
Modulation Technology	DSSS, OFDM
Transfer Rate	802.11b:11Mbps 802.11g: 54Mbps 802.11n: up to 72.2Mbps
Operating Frequency	2412MHz ~ 2472MHz
Number of Channel	13
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	Adapter x1
Data Cable Supplied	NA

Note:

1. The EUT must be supplied with a power adapter and the following different models could be chosen:

No	Brand	Model No.	P/N No.	Spec.
1	NETGEAR	AD2072F20	332-10830-01	Input: 100-240Vac, 0.15A, 50/60Hz Output: 12Vdc, 0.5A DC output cable (Unshielded, 1.8m)
2	NETGEAR	2ACT006F NJ	332-10919-01	Input: 100-240Vac, 0.2A, 50/60Hz Output: 12Vdc, 0.5A DC output cable (Unshielded, 1.8m)

2. The EUT incorporates a SIMO function.

MODULATION MODE	DATA RATE (MCS)	TX & RX CONFIGURATION	
802.11b	1~11Mbps	1TX (Fixed Chain 0)	2RX
802.11g	6~54Mbps	1TX (Fixed Chain 0)	2RX
802.11n (HT20)	MCS 0~7	1TX (Fixed Chain 0)	2RX

3. The power table as below table:

Modulation Mode	Rated output power density (mW/MHz)	Conducted RF output power density (mW/MHz)	Radiated RF output power density (mW/MHz)
802.11b	10	9.956	14.457
802.11g	10	9.707	14.096
802.11n(HT20)	10	9.752	14.161

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

3.2 Description of Test Modes

Operated in 2400 ~ 2483.5MHz band:

13 channels are provided for 802.11b, 802.11g, 802.11n(HT20):

Channel	Freq. (MHz)	Channel	Freq. (MHz)
1	2412	8	2447
2	2417	9	2452
3	2422	10	2457
4	2427	11	2462
5	2432	12	2467
6	2437	13	2472
7	2442		

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 (artgui.exe V2.3) provided by manufacture, the power levels during the tests were set according to the following codes:

802.11b		802.11g	
Channel	Power Setting	Channel	Power Setting
1	21.5	1	22.5
7	20	7	21
13	20	13	21
802.11n (HT20)			
Channel		Power Setting	
1		23	
7		21.5	
13		21.5	

3.3 Test Conditions

Test Conditions	Voltage (Vdc)
V_{normal}	12
V_{max}	13.2
V_{min}	10.8

3.4 Assembly

The EUT is constructed as an IP Camera Base Station. The housing consists of two parts, the parts was fixed together by 2 pcs by special type screws. Separating the two parts was only possible by special tools.

3.5 Antenna Specifications

3.5.1 Antenna Gain

Antenna No.	Transmitter Circuit	Brand	Model No.	Antenna Net Gain (dBi)	Frequency Range (GHz)	Antenna Type	Connector Type
1	Chain (0)	Master Wave	902E00006N0	1.62	2.4~2.4835	PIFA	NA
2	Chain (1)	Master Wave	902E00007N0	2.58	2.4~2.4835	PIFA	NA

Note: For transmission mode will fix transmission on Chain (0)

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

802.11b / 802.11g / 802.11n (HT20):

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)
1	2412	2411.987760	-5.074	2411.986960	-5.406	2411.986560	-5.572
7	2442	2441.986360	-5.585	2441.986040	-5.716	2441.985960	-5.749
13	2472	2471.985880	-5.711	2471.985840	-5.728	2471.985840	-5.728

4.2 Occupied Bandwidth Measurement (99% power bandwidth)

4.2.1 Limits of Occupied Bandwidth Measurement

Item	Limit	Remark
Occupied bandwidth	<26MHz	For 802.11b, g & 802.11n (HT20)

4.2.2 Test Setup



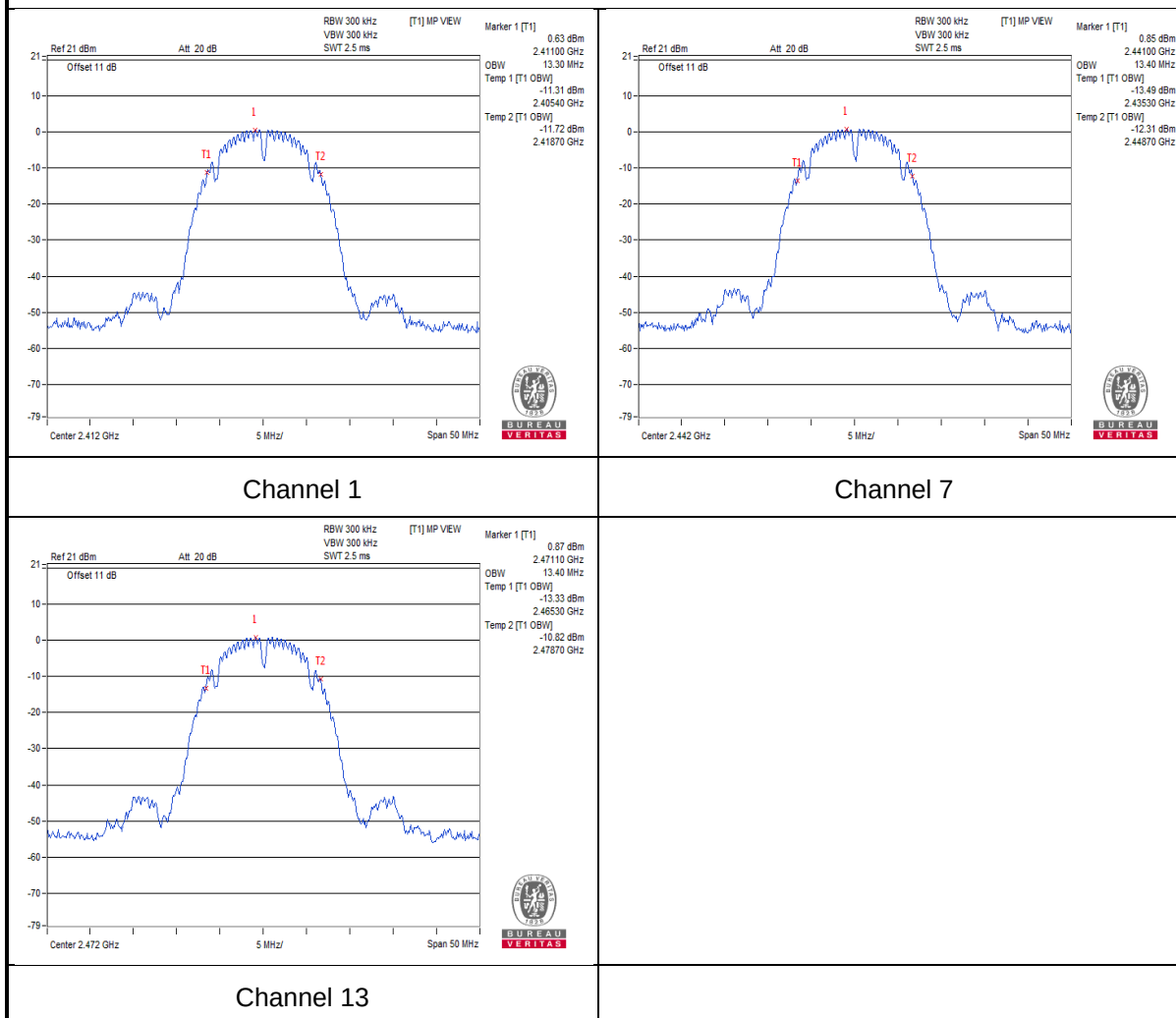
4.2.3 Test Results

802.11b

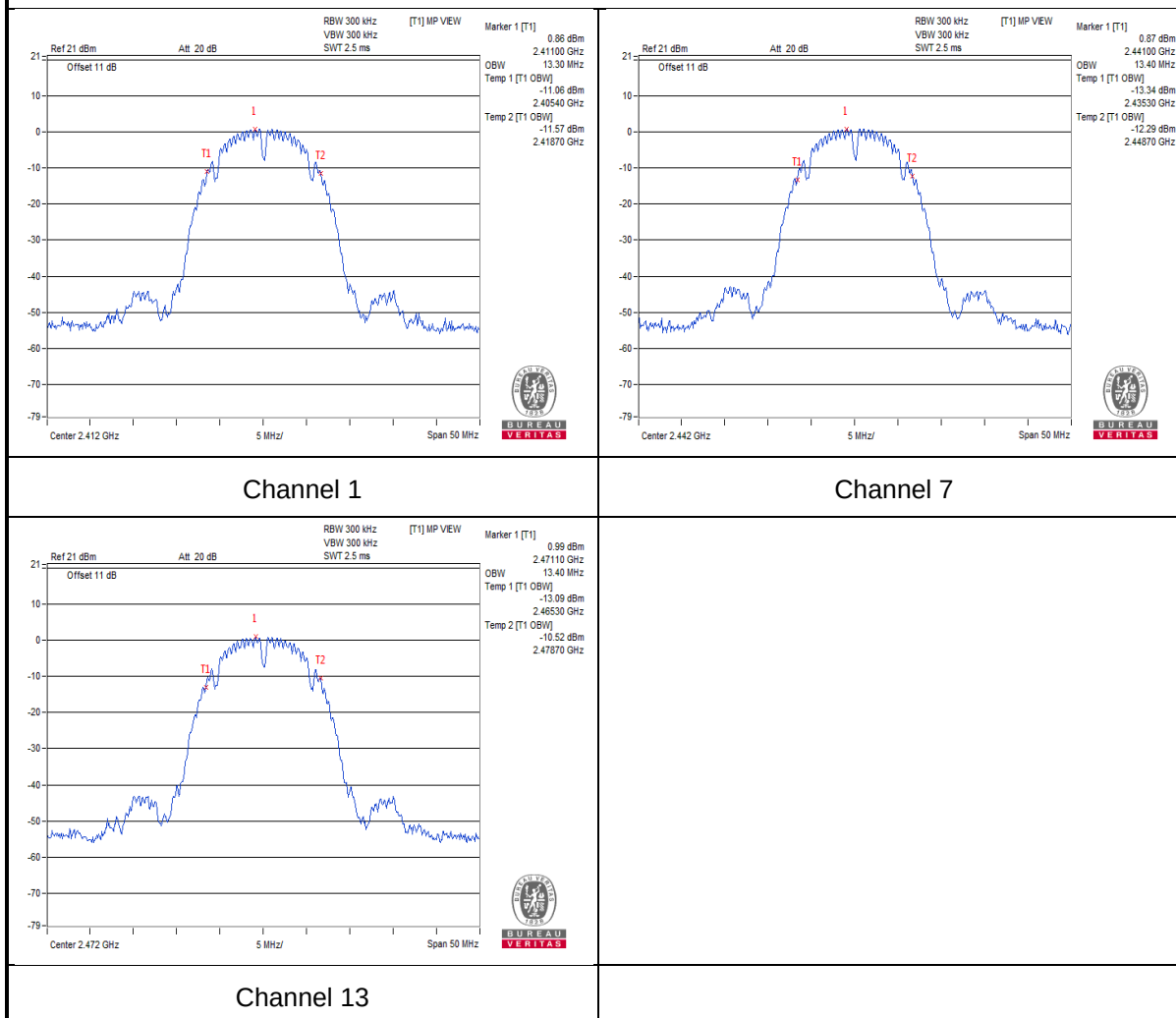
Environmental Conditions		25 deg.C, 60% RH		
Channel	Frequency (MHz)	V_{normal}	V_{max}	V_{min}
		Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)
1	2412	13.30	13.30	13.30
7	2442	13.40	13.40	13.40
13	2472	13.40	13.40	13.40

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

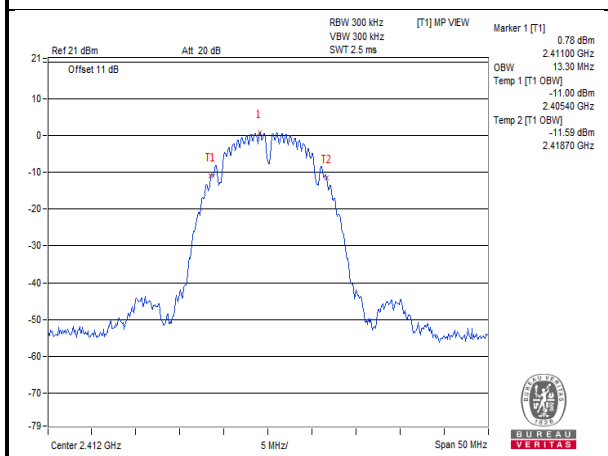
V_{normal}



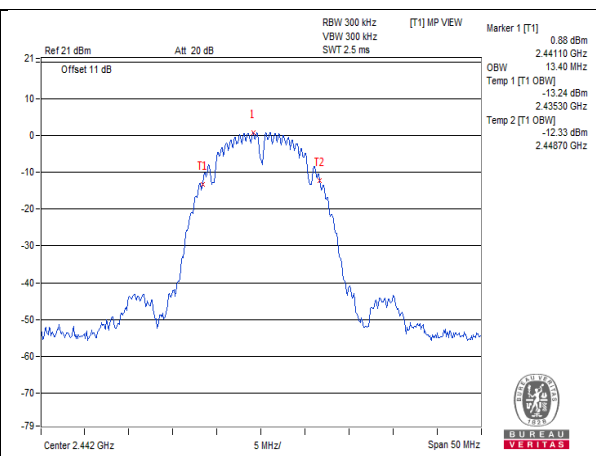
V+10%



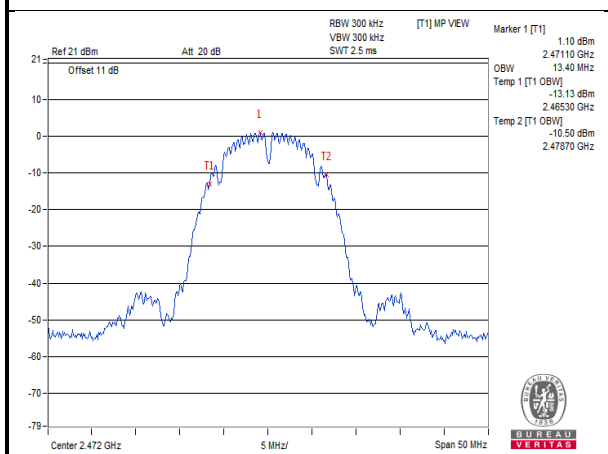
V-10%



Channel 1



Channel 7



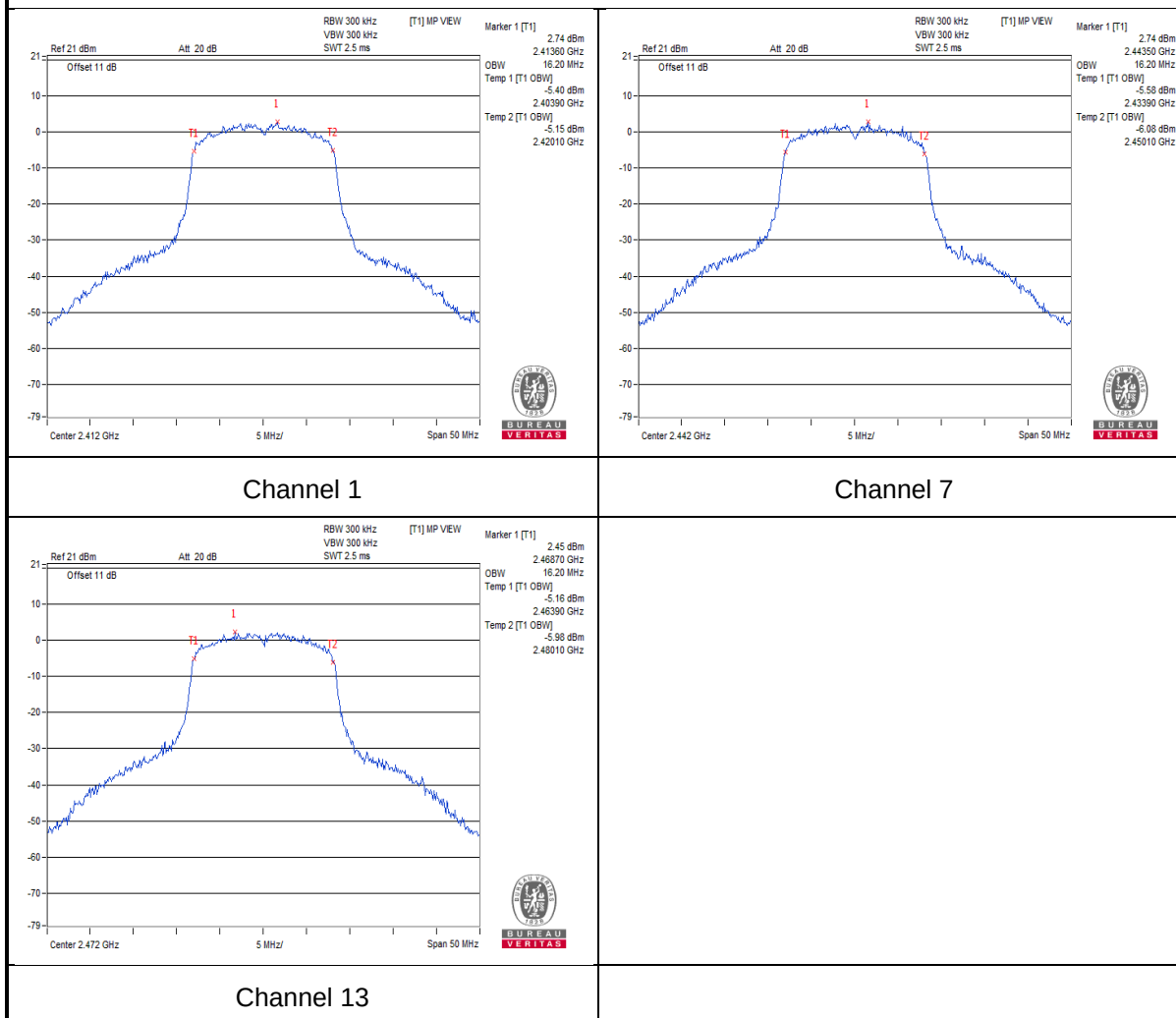
Channel 13

802.11g

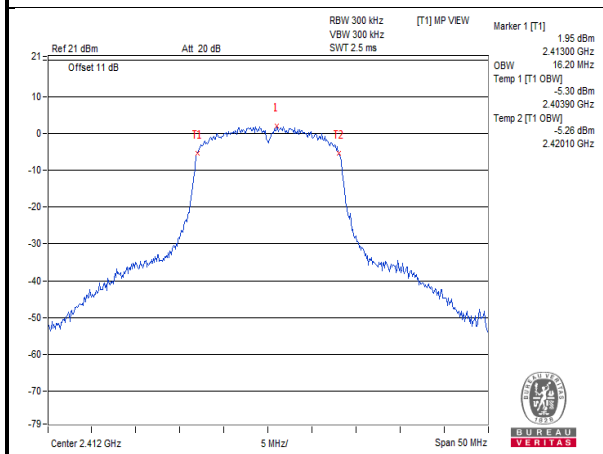
Environmental Conditions		25 deg.C, 60% RH		
Channel	Frequency (MHz)	V _{normal}	V _{max}	V _{min}
		Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)
1	2412	16.20	16.20	16.20
7	2442	16.20	16.20	16.20
13	2472	16.20	16.20	16.20

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

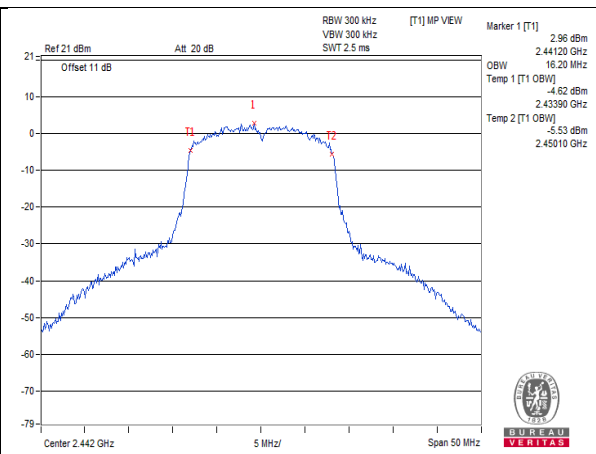
V_{normal}



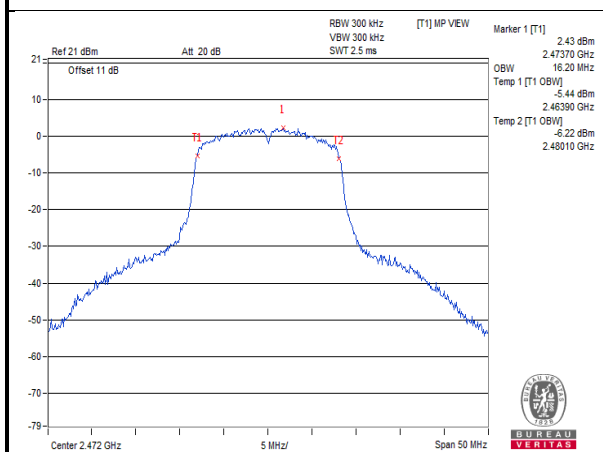
V +10%



Channel 1

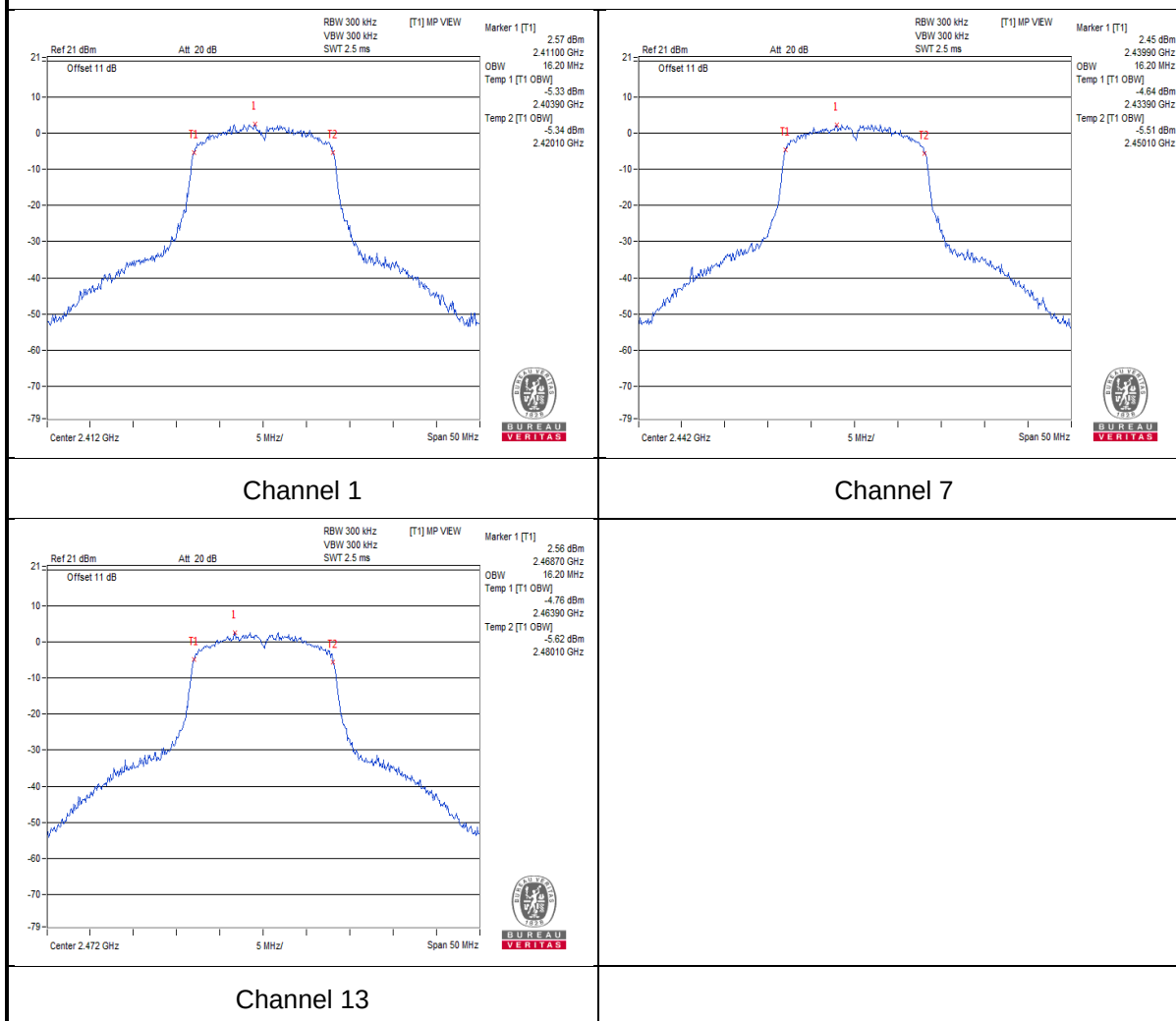


Channel 7



Channel 13

V-10%

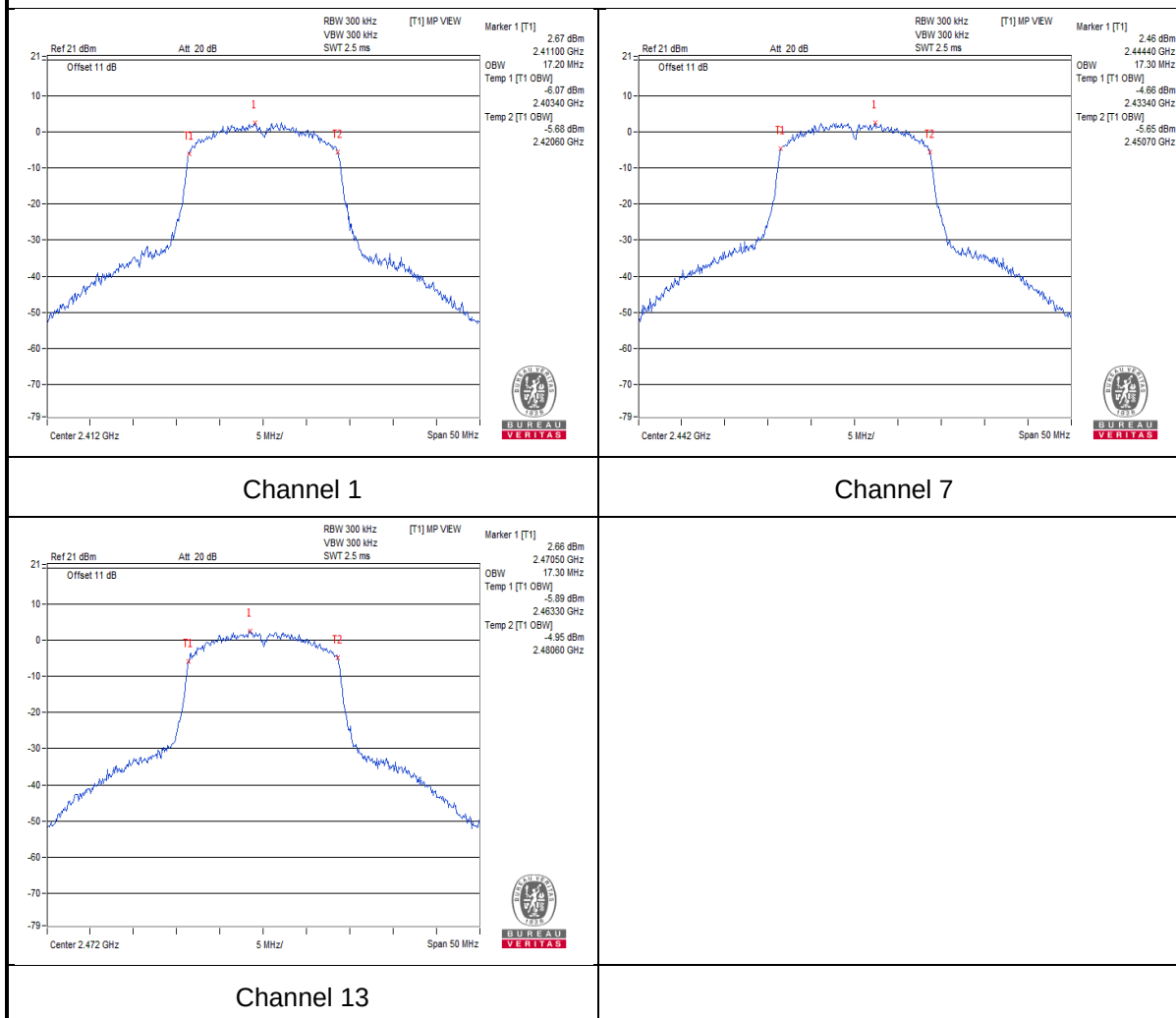


802.11n (HT20)

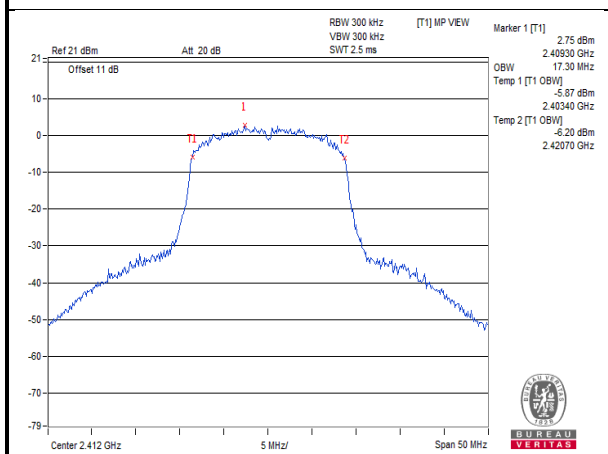
Environmental Conditions		25 deg.C, 60% RH		
Channel	Frequency (MHz)	V _{normal}	V _{max}	V _{min}
		Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)
1	2412	17.20	17.30	17.30
7	2442	17.30	17.20	17.20
13	2472	17.30	17.20	17.20

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

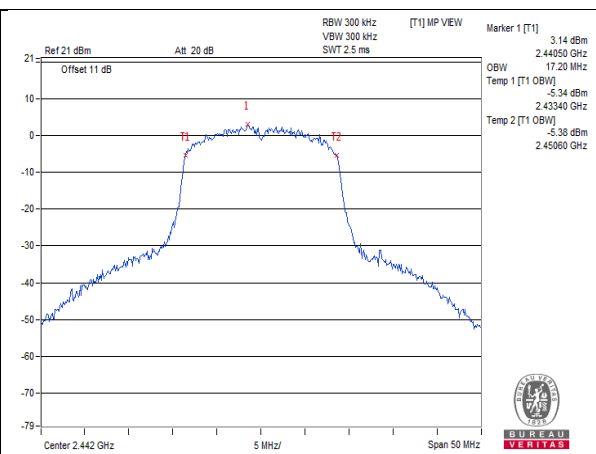
V_{normal}



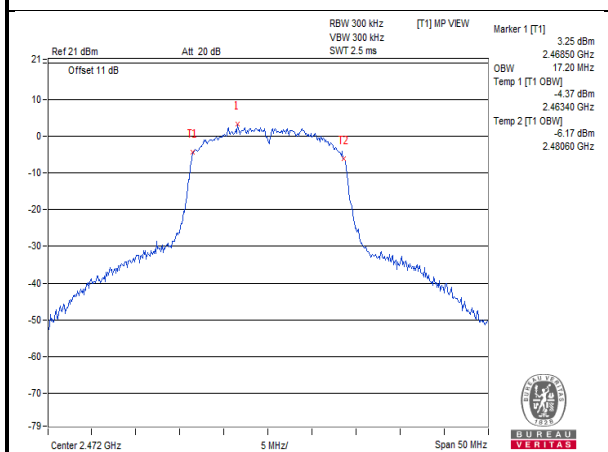
V +10%



Channel 1

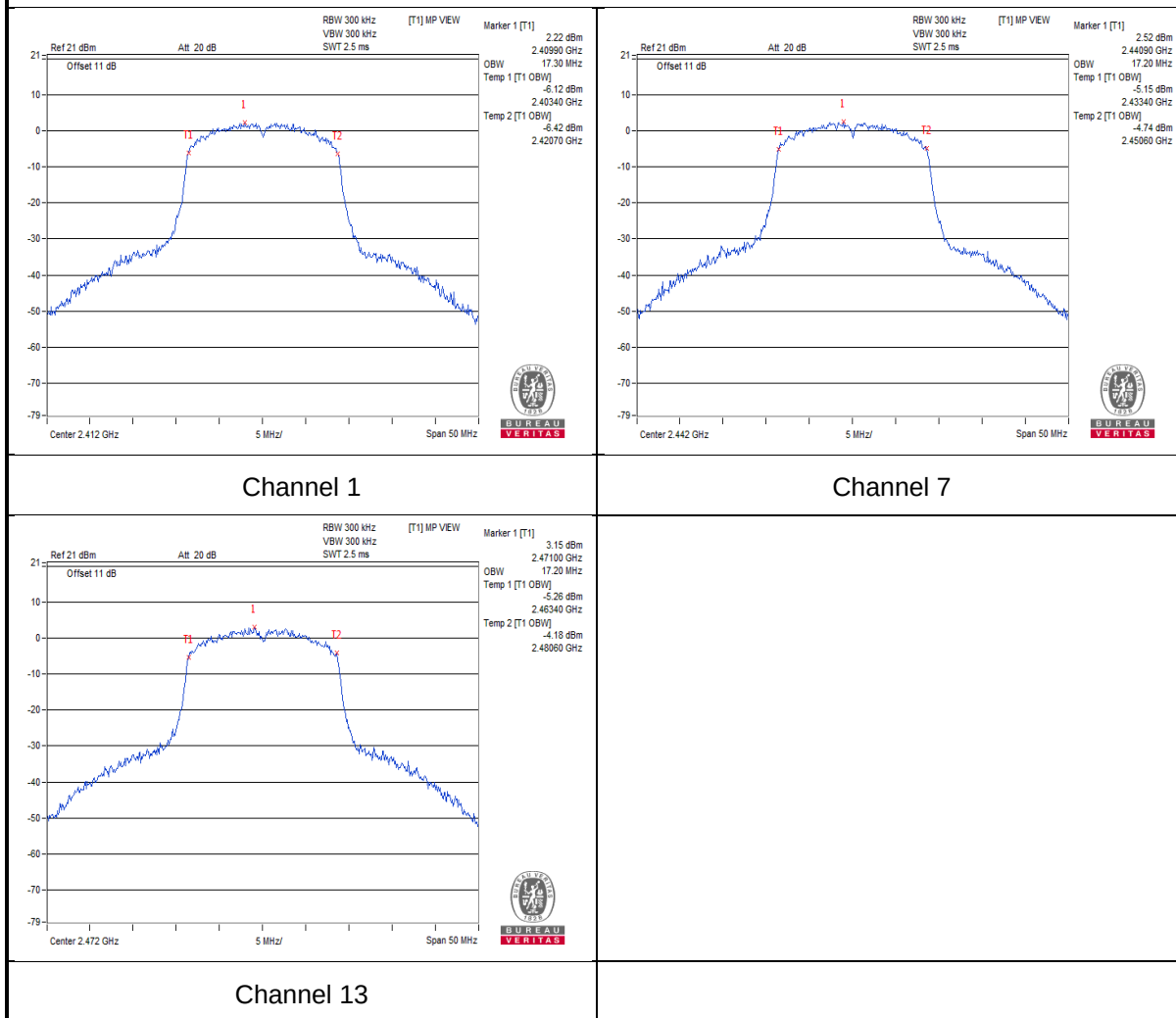


Channel 7



Channel 13

V-10%

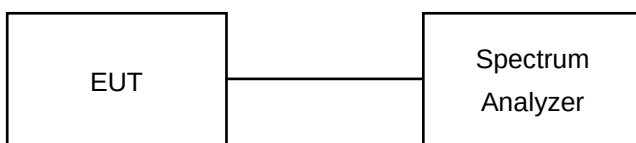


4.3 Spreading Bandwidth Measurement (90% power bandwidth)

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



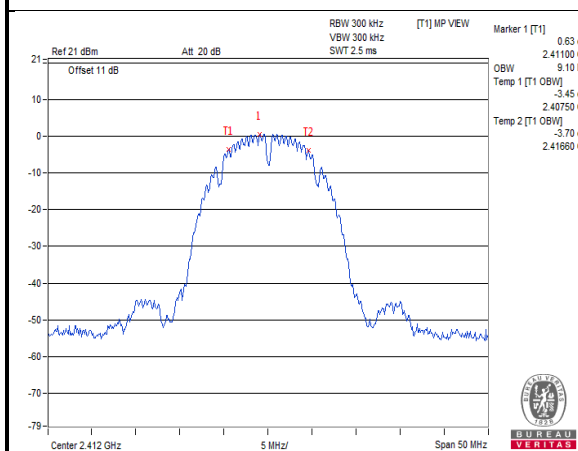
4.3.3 Test Results

802.11b_Data Rate: 1Mbps

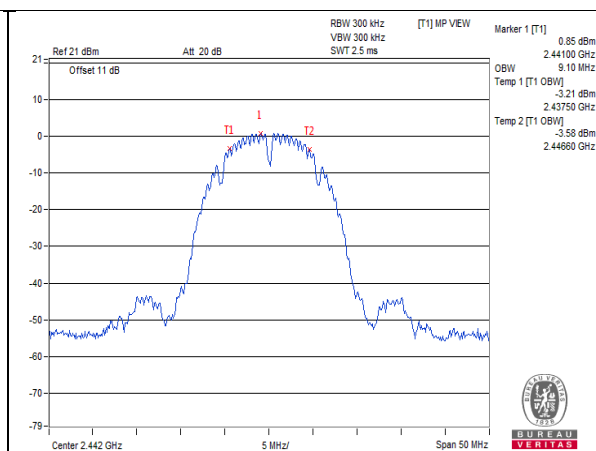
Environmental Conditions		25 deg.C, 60% RH					
Channel	Frequency (MHz)	V_{normal}		V_{max}		V_{min}	
		Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor
1	2412	9.10	9.10	9.10	9.10	9.10	9.10
7	2442	9.10	9.10	9.10	9.10	9.10	9.10
13	2472	9.10	9.10	9.10	9.10	9.20	9.20

Note: 1. For the test plots please refer to the below pages.
 2. Spreading Factor: 90% channel power bandwidth / 1

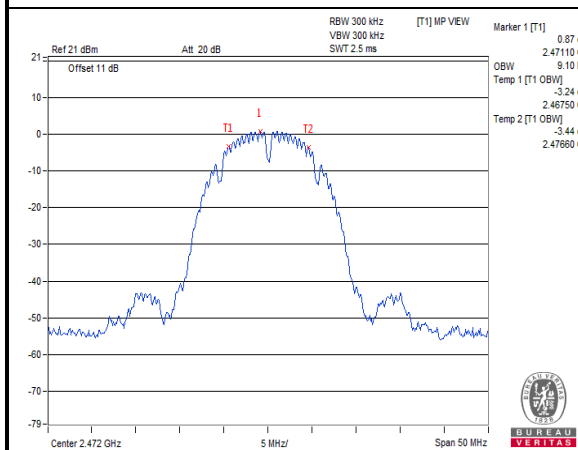
V_{normal}



Channel 1

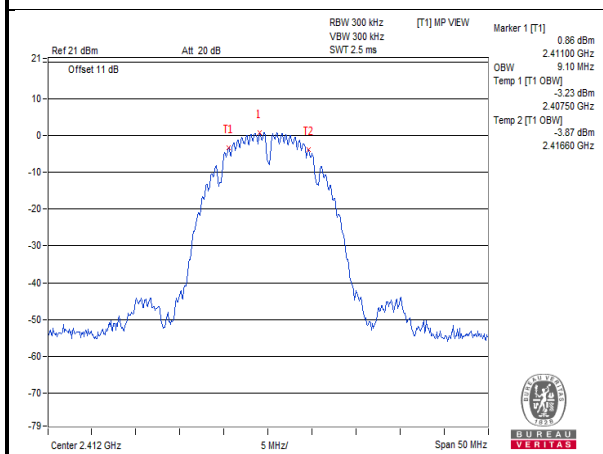


Channel 7

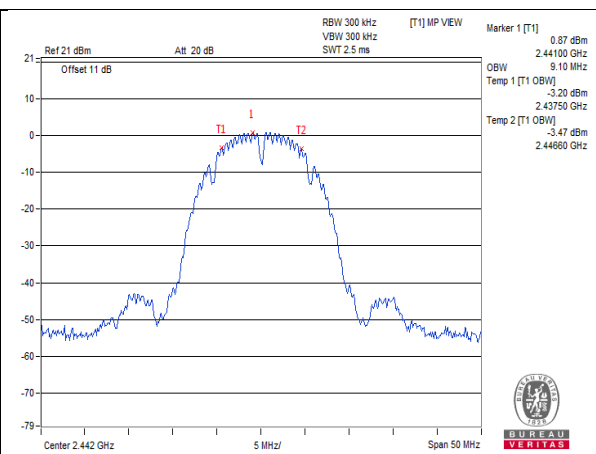


Channel 13

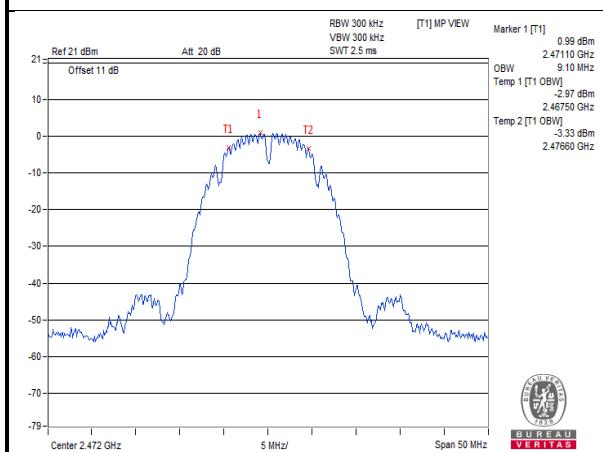
V +10%



Channel 1

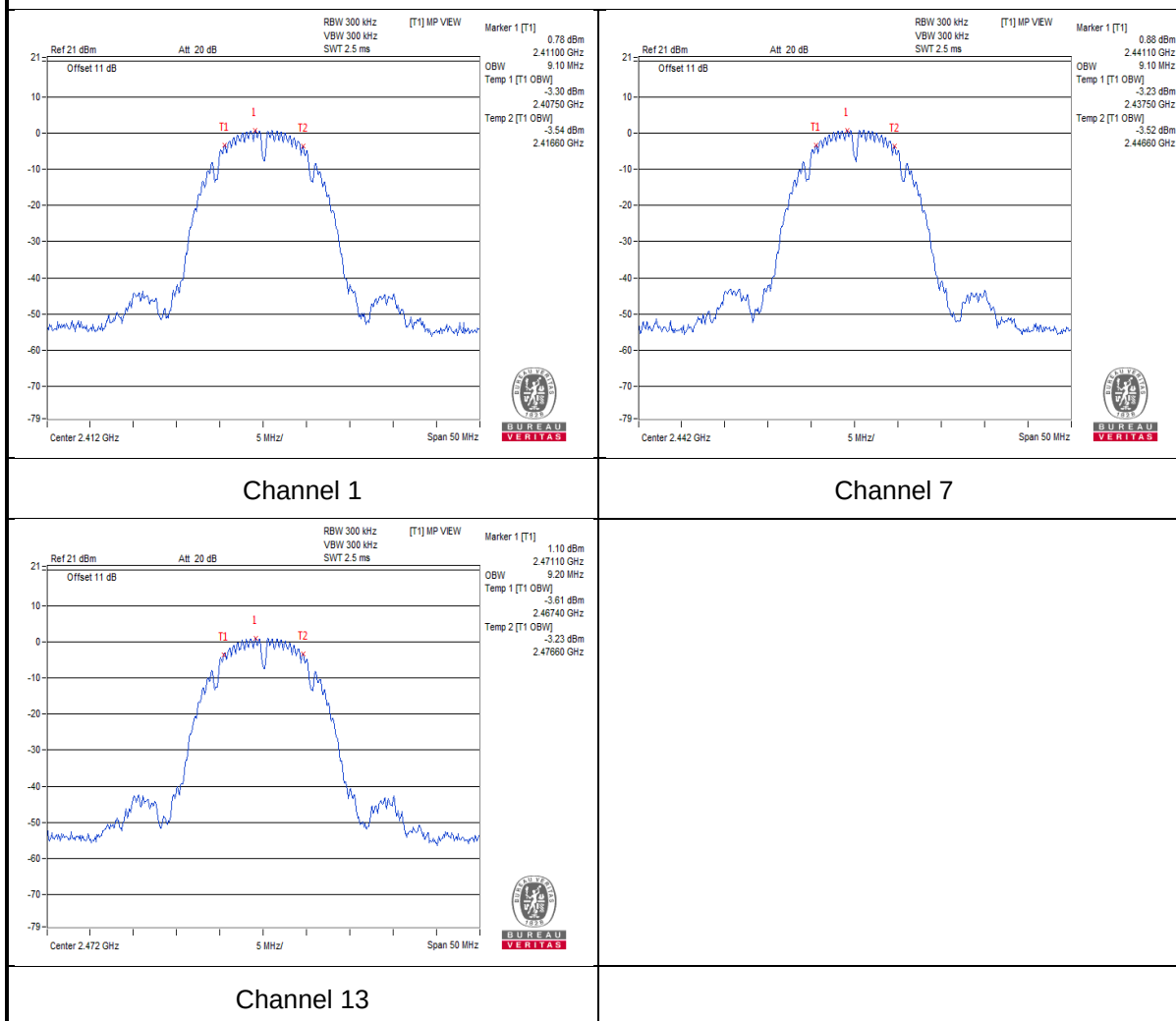


Channel 7



Channel 13

V-10%

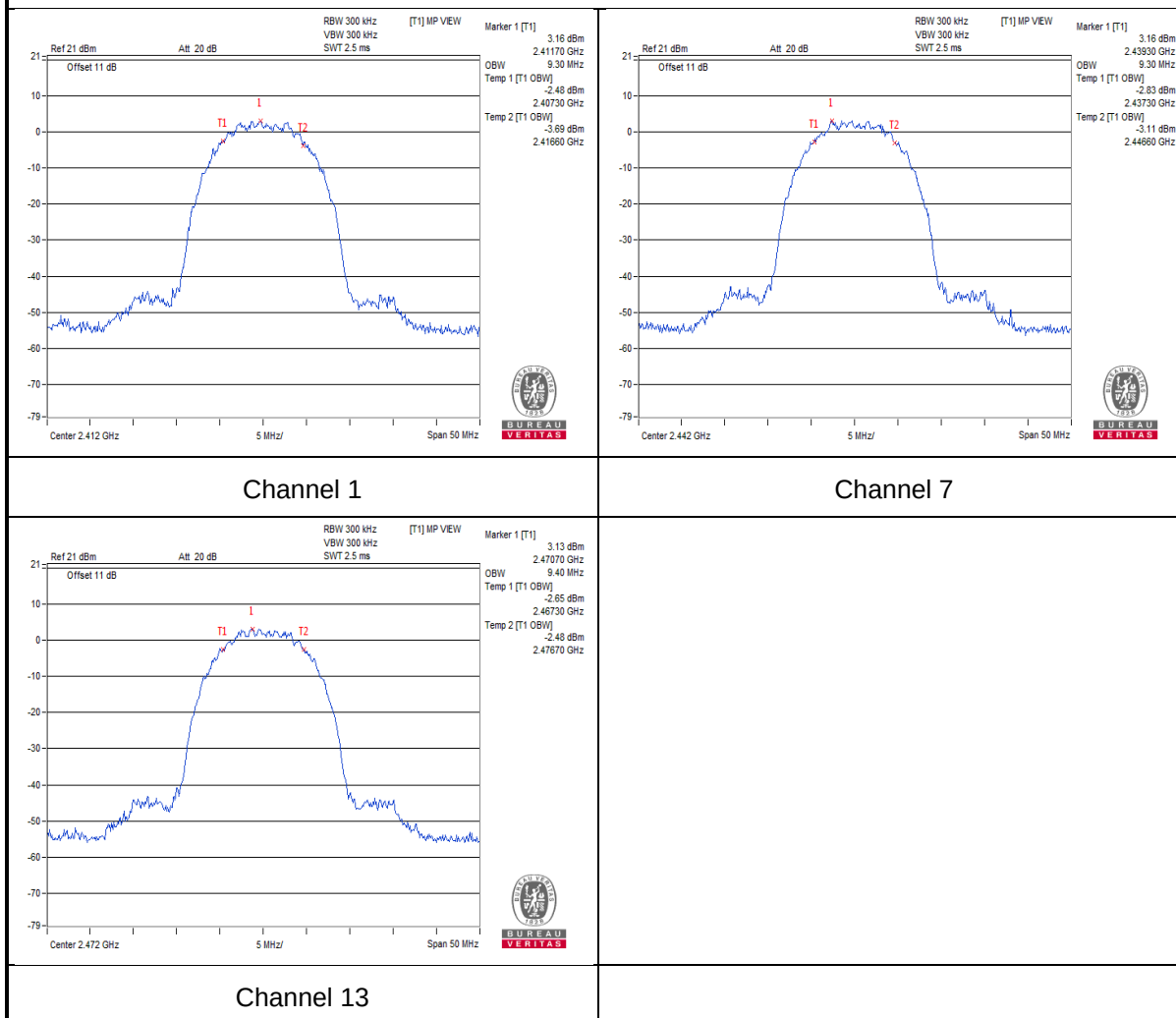


802.11b Data Rate: 5.5Mbps

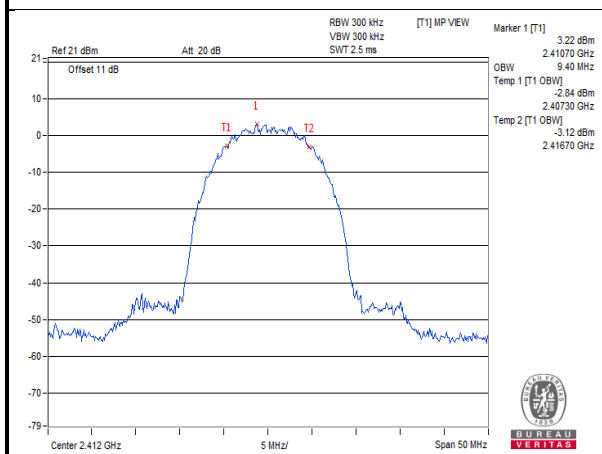
Environmental Conditions		25 deg.C, 60% RH					
Channel	Frequency (MHz)	V _{normal}		V _{max}		V _{min}	
		Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor
1	2412	9.30	6.76	9.40	6.83	9.30	6.76
7	2442	9.30	6.76	9.50	6.90	9.40	6.83
13	2472	9.40	6.83	9.40	6.83	9.40	6.83

- Note:
1. For the test plots please refer to the below pages.
 2. Spreading Factor: 90% channel power bandwidth / 1.375

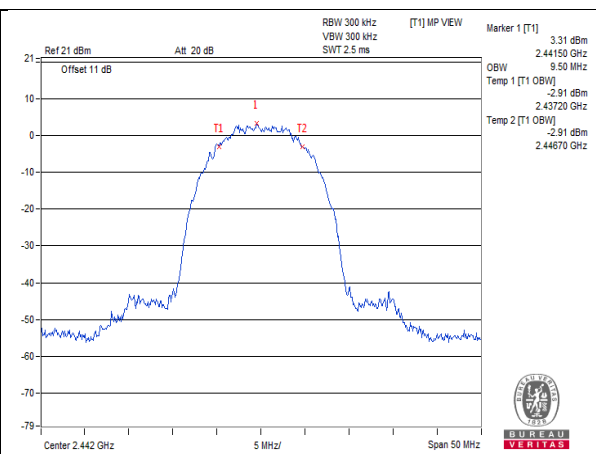
V_{normal}



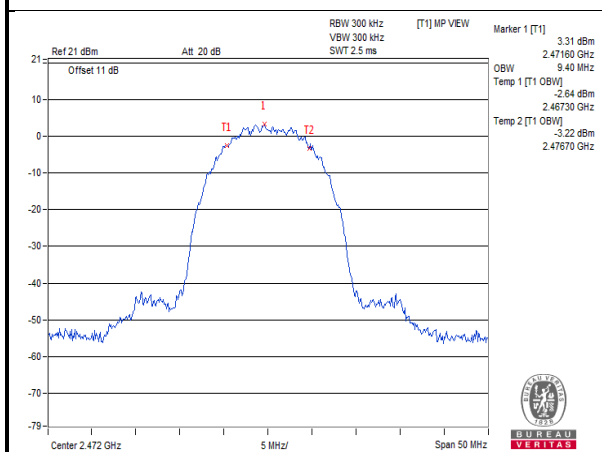
V +10%



Channel 1

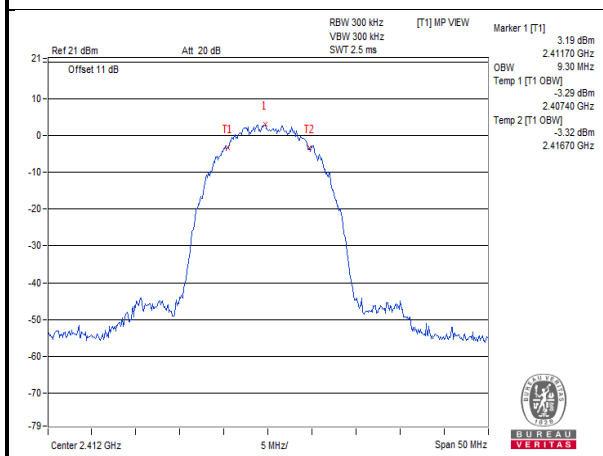


Channel 7

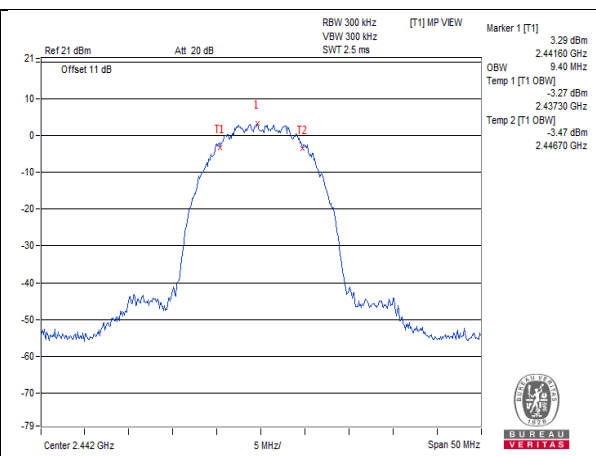


Channel 13

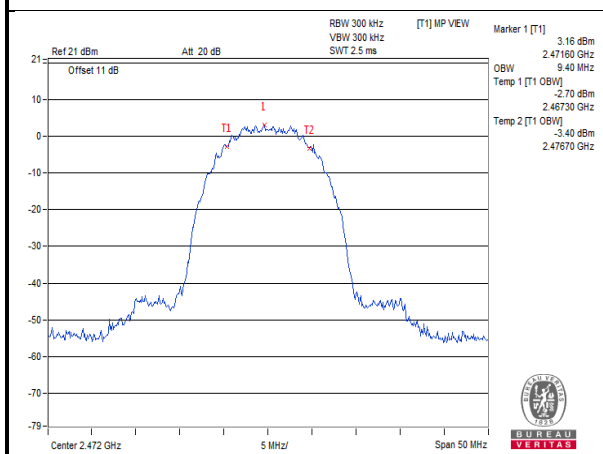
V-10%



Channel 1



Channel 7



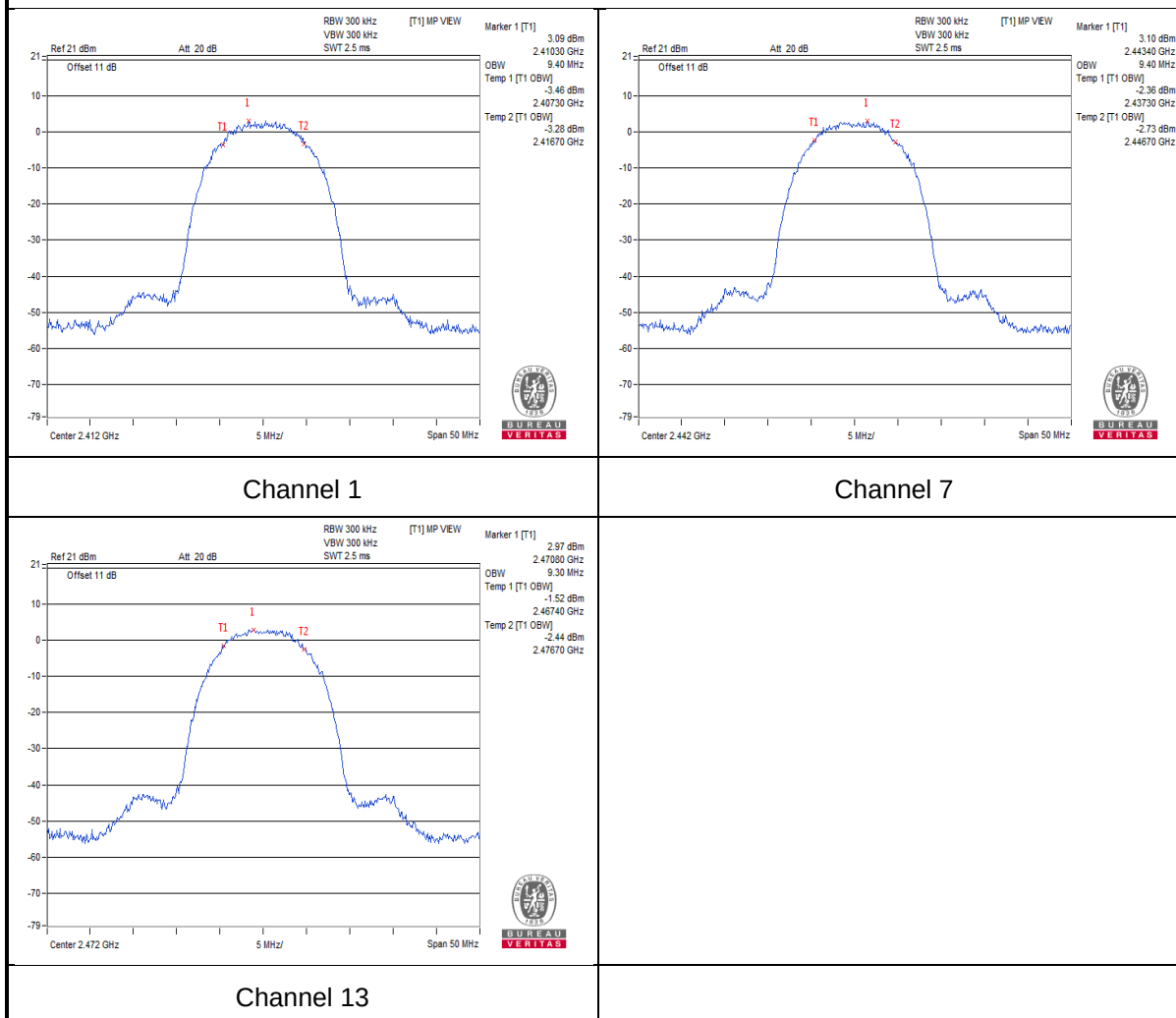
Channel 13

802.11b_Data Rate: 11Mbps

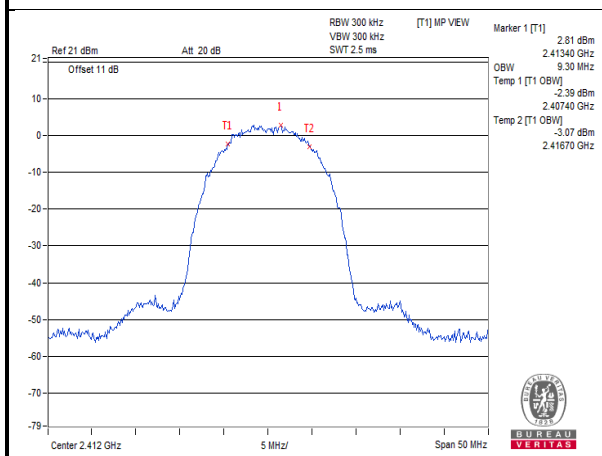
Environmental Conditions		25 deg.C, 60% RH					
Channel	Frequency (MHz)	V_{normal}		V_{max}		V_{min}	
		Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor
1	2412	9.40	6.83	9.30	6.76	9.40	6.83
7	2442	9.40	6.83	9.30	6.76	9.30	6.76
13	2472	9.30	6.76	9.40	6.83	9.40	6.83

Note: 1. For the test plots please refer to the below pages.
 2. Spreading Factor: 90% channel power bandwidth / 1.375

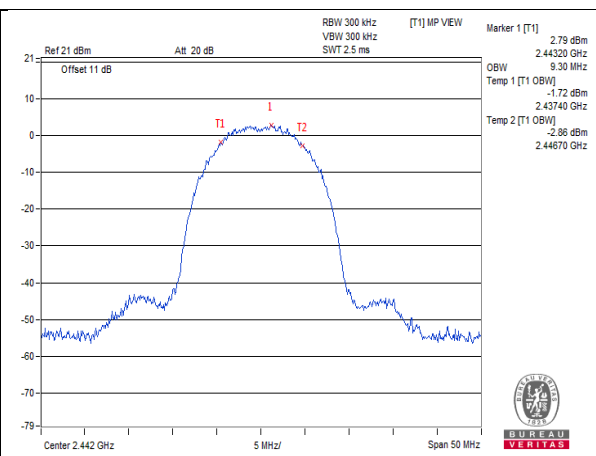
V_{normal}



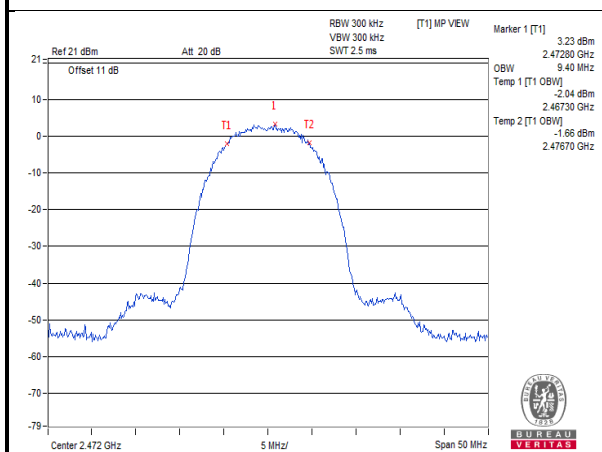
V +10%



Channel 1

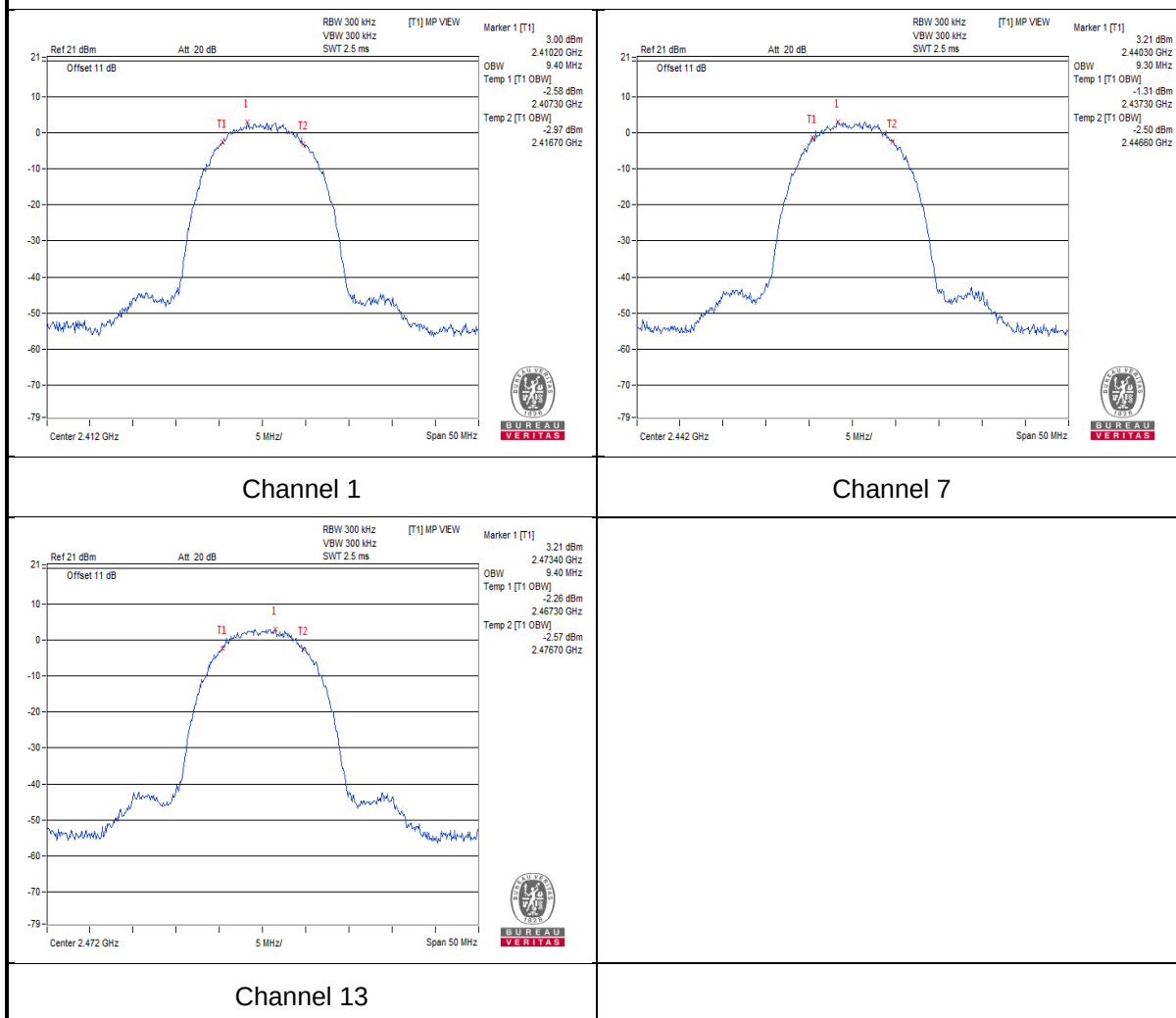


Channel 7



Channel 13

V-10%



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

802.11b

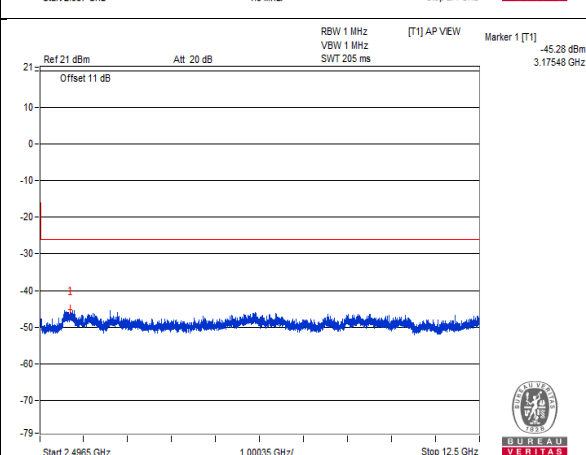
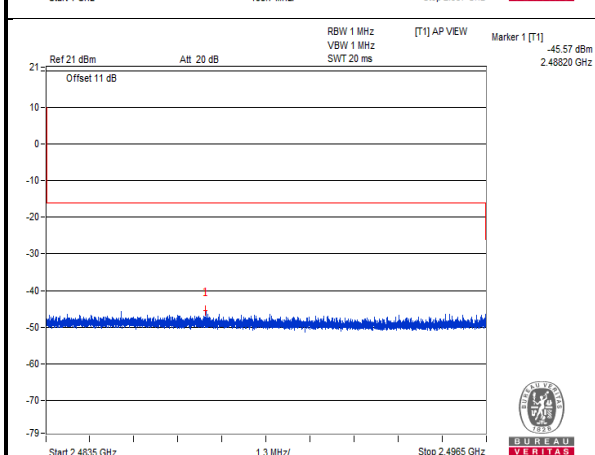
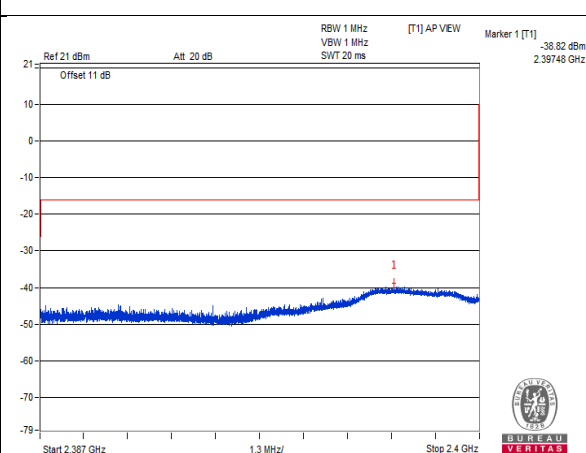
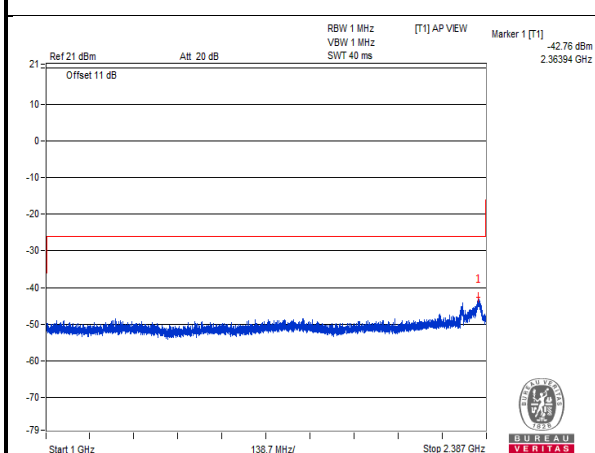
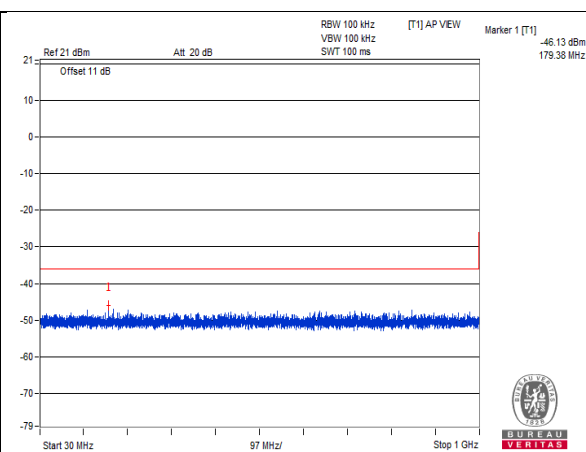
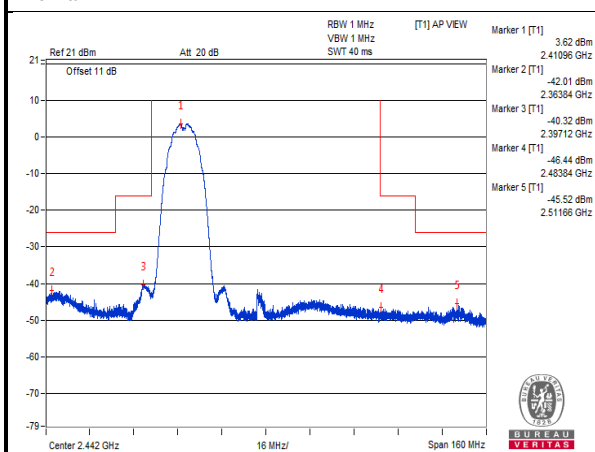
Environmental Conditions		25 deg.C, 60% RH					
Test Channel		CH1 (2412MHz)		CH7 (2442MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value	Frequency (MHz)	Measured Value		
V _{normal}	30.0MHz to 1000.0MHz	179.38	0.024uW	125.66	0.02uW	0.25 uW/100kHz	PASS
	1000.0MHz to 2387MHz	2363.94	0.052uW	2340.88	0.056uW	2.5 uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2397.48	0.131uW	2396.57	0.089uW	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2488.2	0.027uW	2490.01	0.052uW	25 uW/MHz	PASS
	2496.5MHz to 12500.0MHz	3175.48	0.029uW	3170.48	0.029uW	2.5 uW/MHz	PASS
V _{max}	30.0MHz to 1000.0MHz	602.78	0.02uW	259.4	0.019uW	0.25 uW/100kHz	PASS
	1000.0MHz to 2387MHz	2364.63	0.05uW	2343.48	0.061uW	2.5 uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2397.47	0.118uW	2395.67	0.078uW	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2483.52	0.026uW	2488.18	0.044uW	25 uW/MHz	PASS
	2496.5MHz to 12500.0MHz	3130.47	0.036uW	3081.7	0.028uW	2.5 uW/MHz	PASS
V _{min}	30.0MHz to 1000.0MHz	135.12	0.019uW	79.1	0.021uW	0.25 uW/100kHz	PASS
	1000.0MHz to 2387MHz	2364.46	0.058uW	2340.88	0.059uW	2.5 uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2397.55	0.125uW	2395.23	0.086uW	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2484.8	0.023uW	2488.86	0.05uW	25 uW/MHz	PASS
	2496.5MHz to 12500.0MHz	7366.95	0.028uW	3147.97	0.033uW	2.5 uW/MHz	PASS

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

Test Channel		CH13 (2472MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value		
V _{normal}	30.0MHz to 1000.0MHz	152.22	0.019uW	0.25 uW/ 100kHz	PASS
	1000.0MHz to 2387MHz	2372.43	0.082uW	2.5 uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2387.98	0.045uW	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2487.46	0.224uW	25 uW/MHz	PASS
	2496.5MHz to 12500.0MHz	3124.21	0.034uW	2.5 uW/MHz	PASS
V _{max}	30.0MHz to 1000.0MHz	681.23	0.022uW	0.25 uW/ 100kHz	PASS
	1000.0MHz to 2387MHz	2373.3	0.069uW	2.5 uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2397.85	0.045uW	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2486.48	0.133uW	25 uW/MHz	PASS
	2496.5MHz to 12500.0MHz	3189.24	0.03uW	2.5 uW/MHz	PASS
V _{min}	30.0MHz to 1000.0MHz	746.83	0.041uW	0.25 uW/ 100kHz	PASS
	1000.0MHz to 2387MHz	2374.17	0.065uW	2.5 uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2398.31	0.049uW	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2486.81	0.13uW	25 uW/MHz	PASS
	2496.5MHz to 12500.0MHz	6920.54	0.028uW	2.5 uW/MHz	PASS

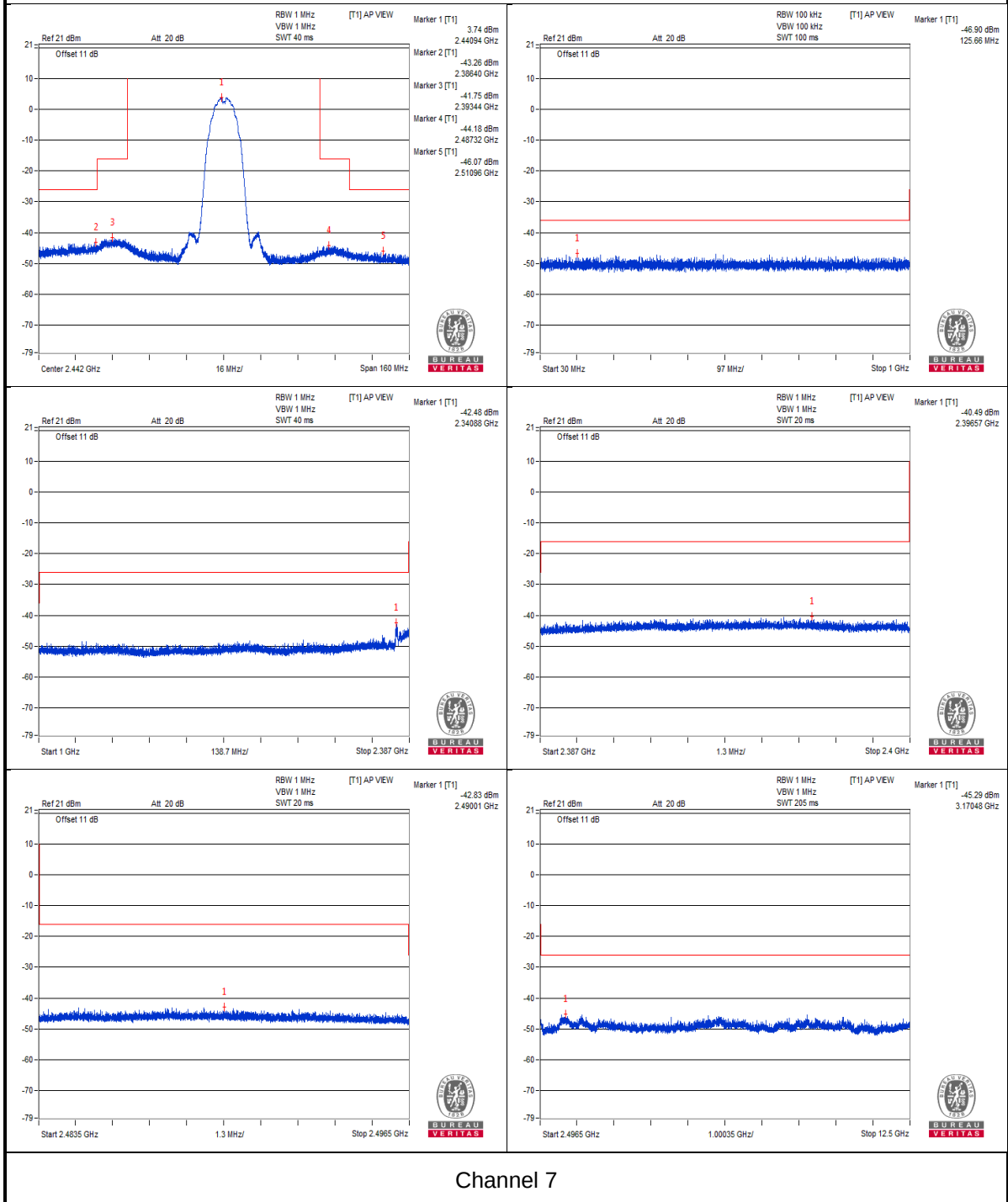
- Note: 1. The worst value in each frequency range v.s. each channel has been marked by boldface.
2. The spectrum plots are attached on the following pages.

Vnormal

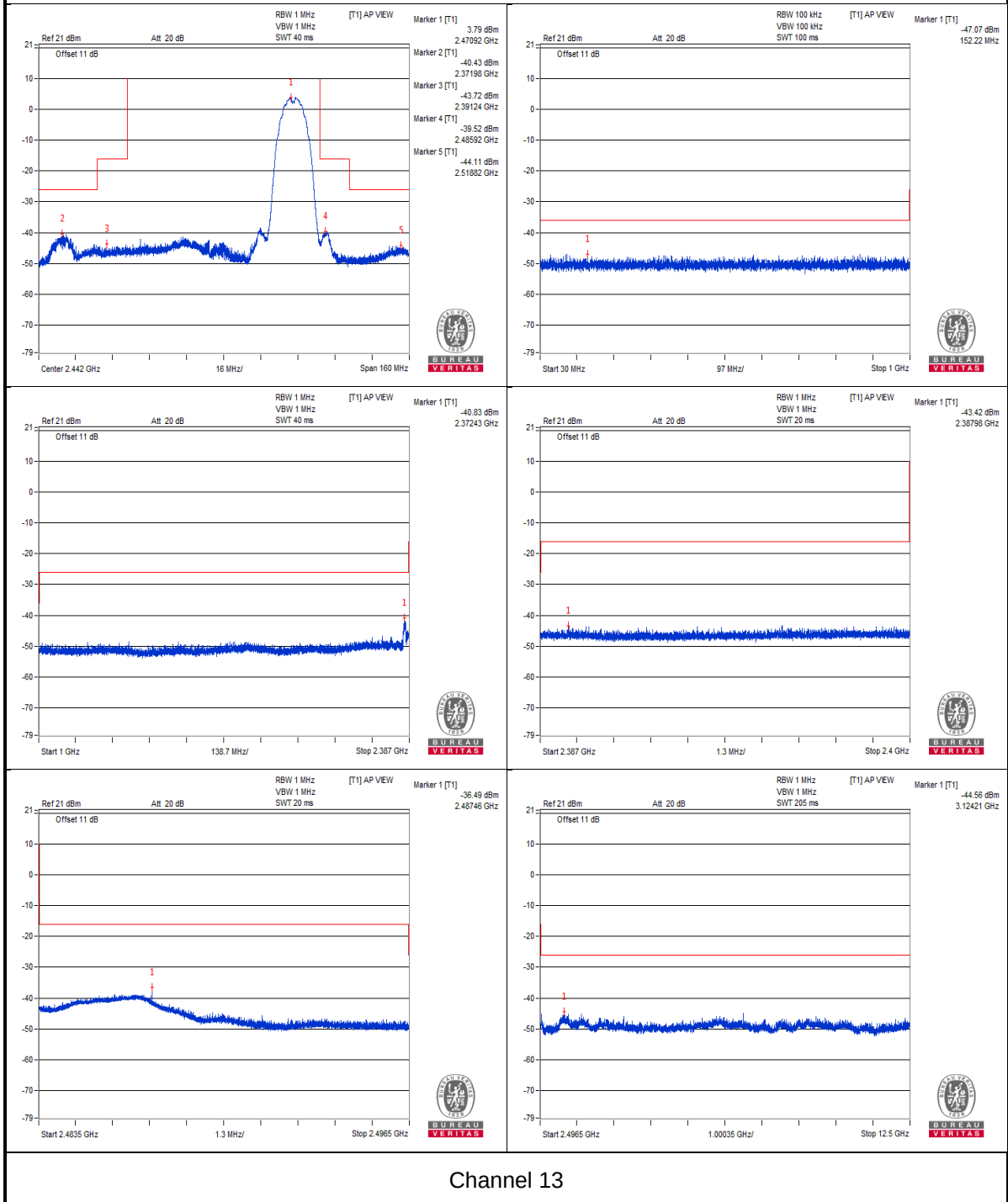


Channel 1

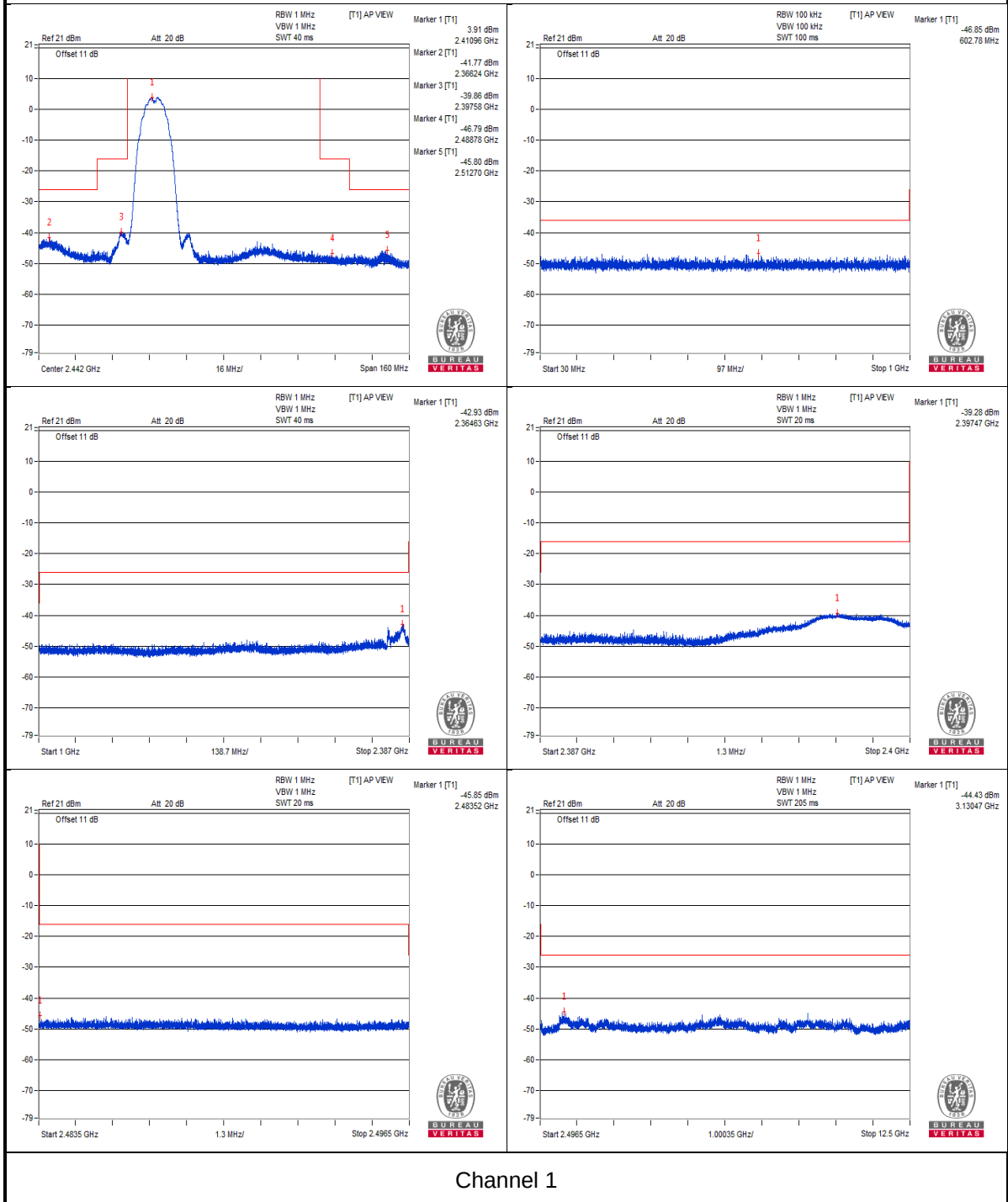
Vnormal



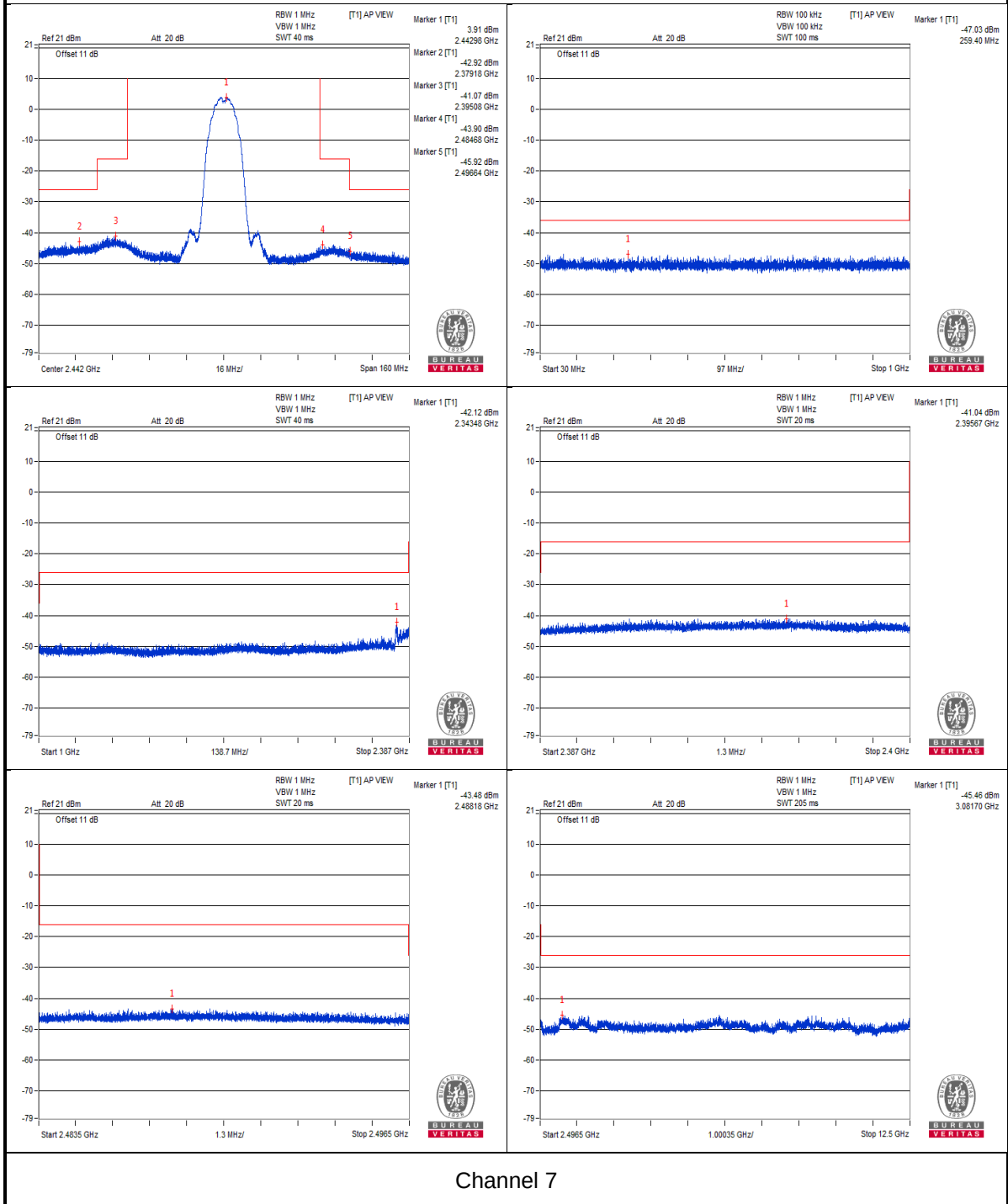
Vnormal



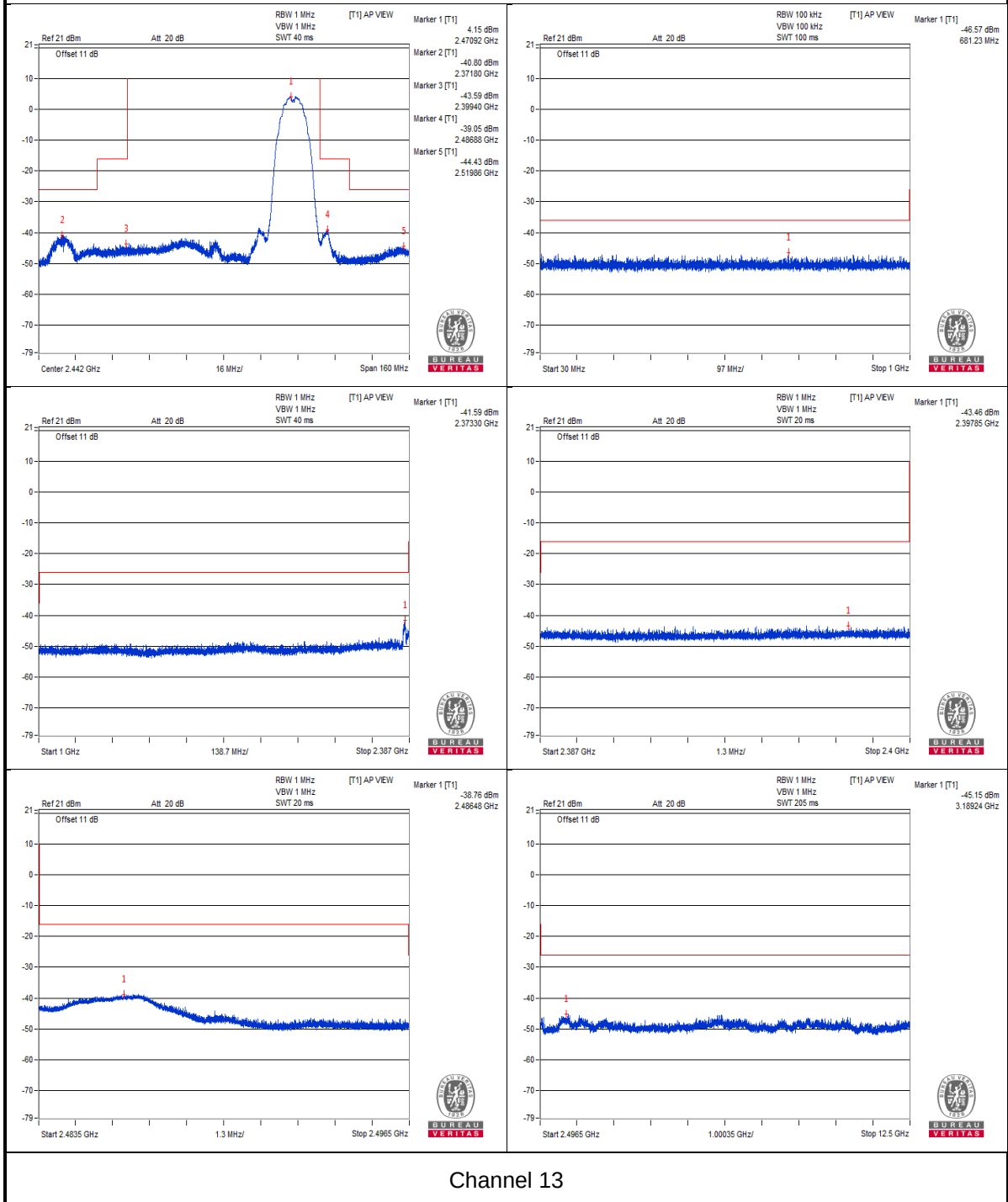
V+10%



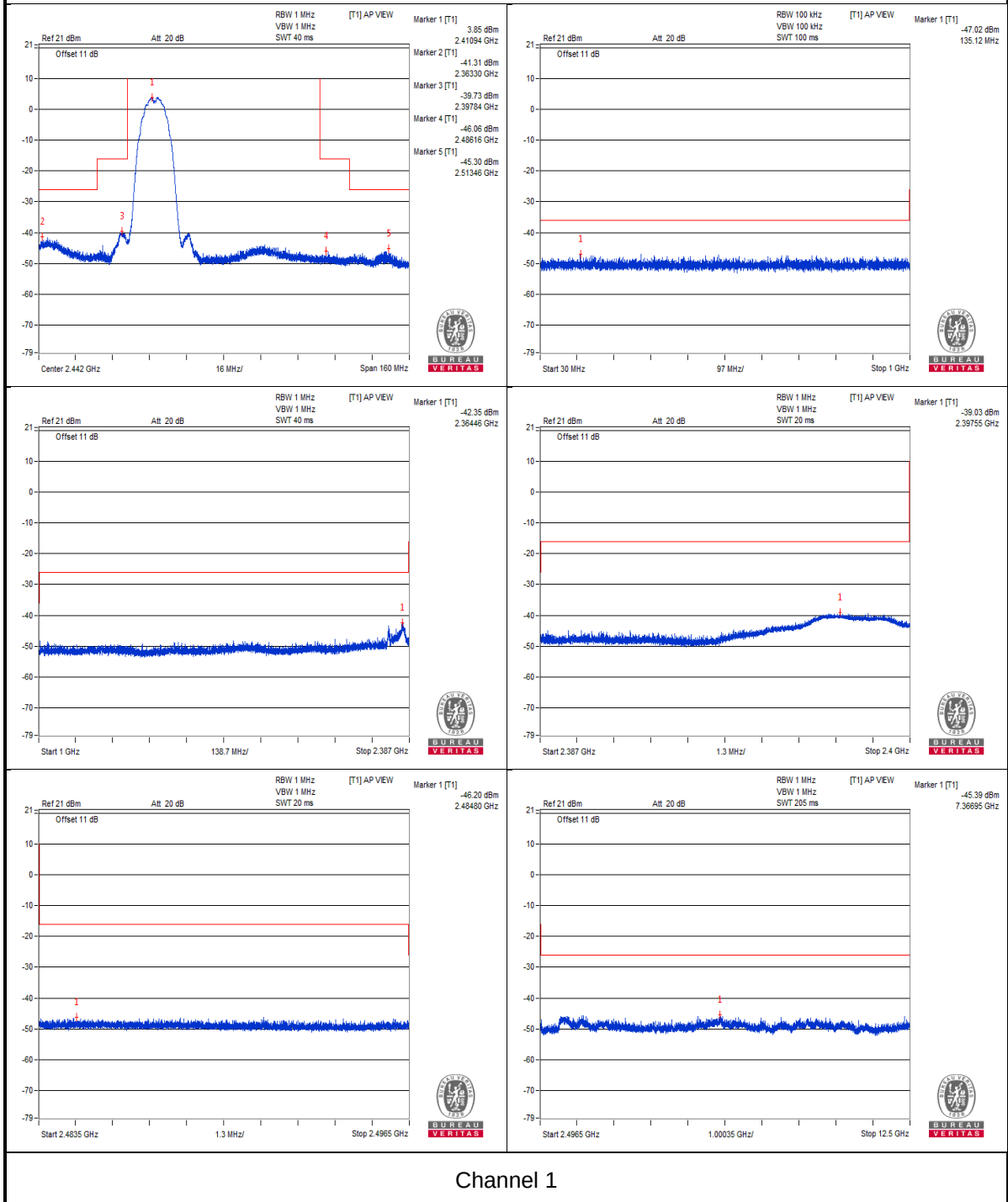
V+10%



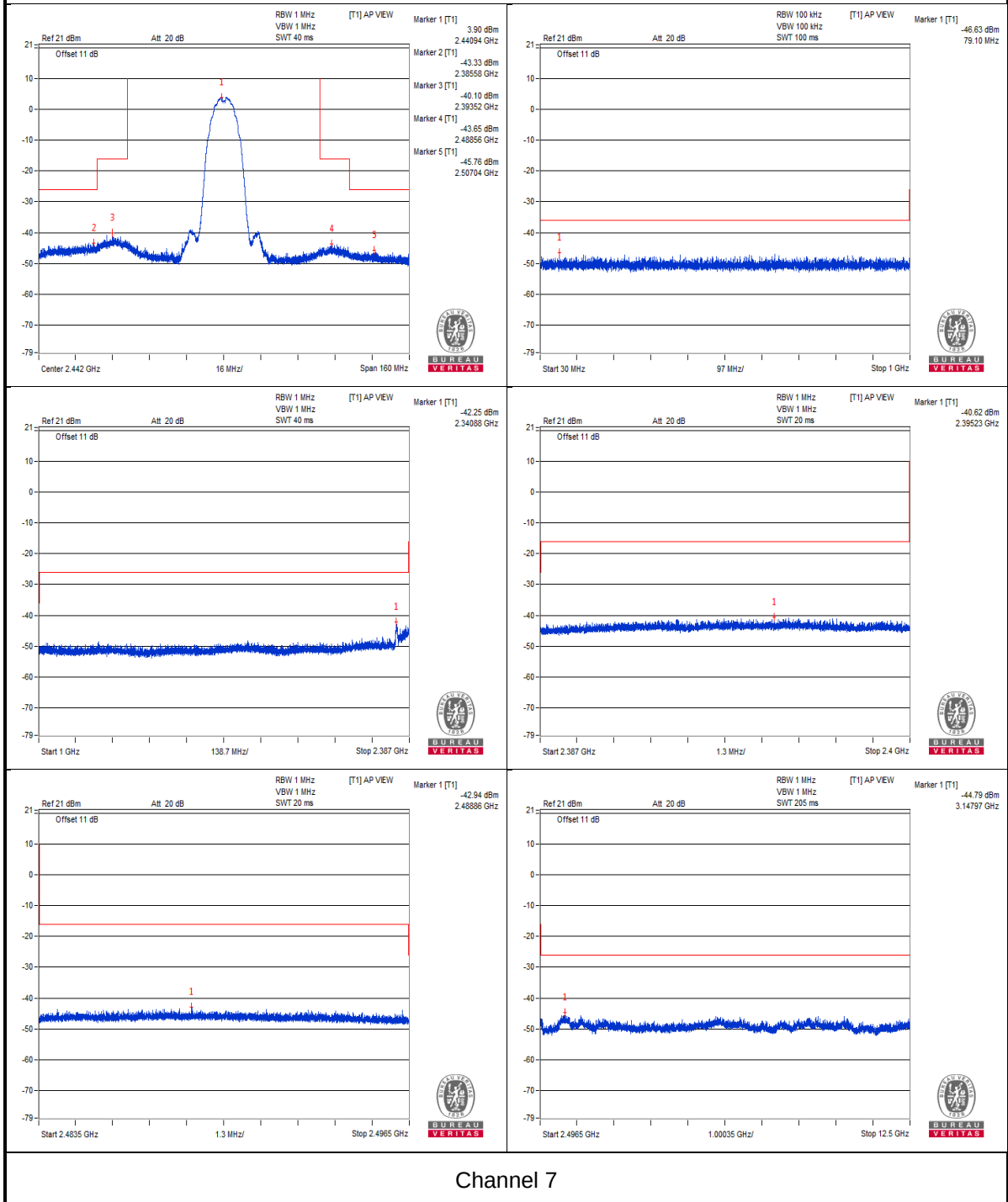
V+10%



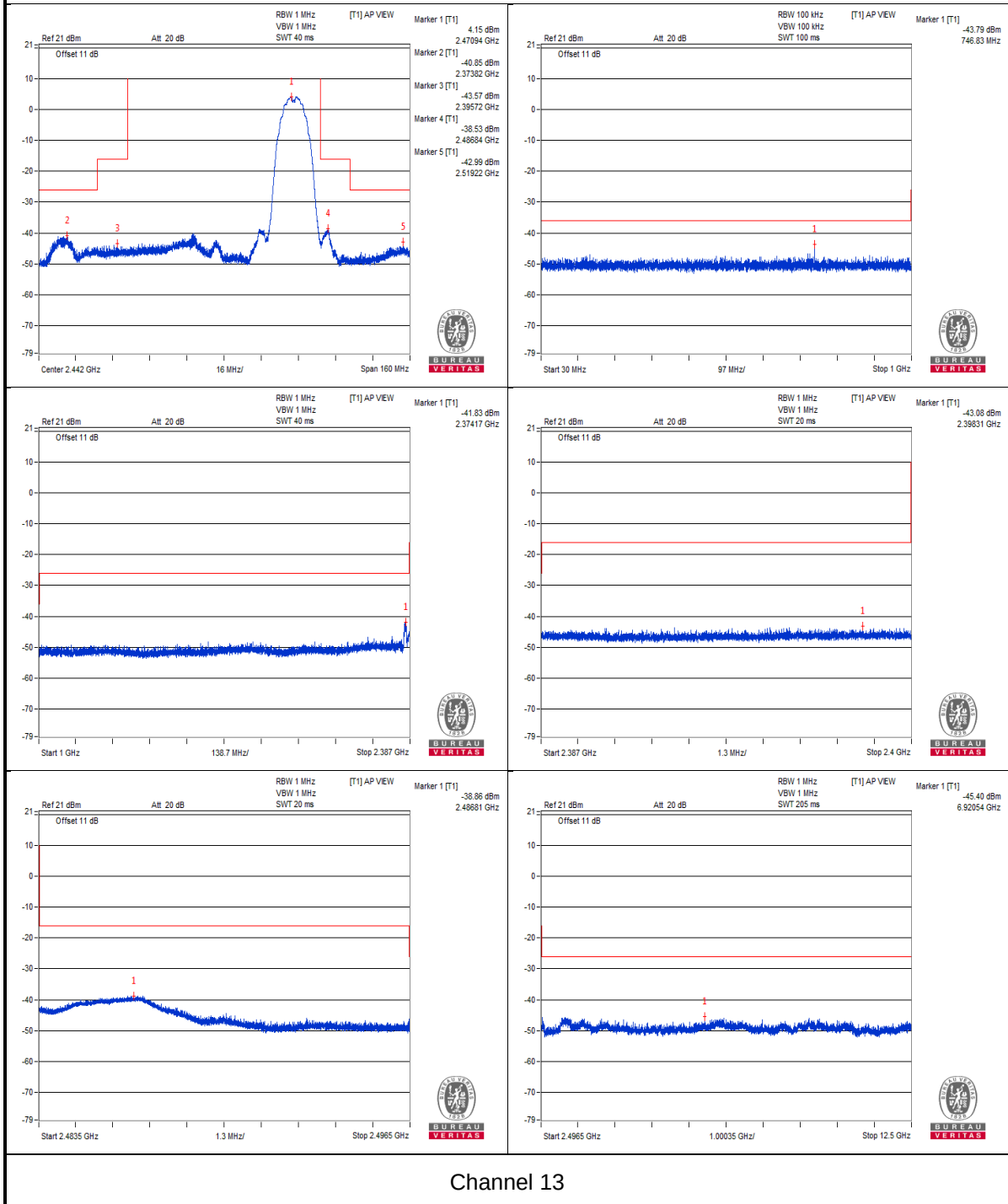
V-10%



V-10%



V-10%



802.11g

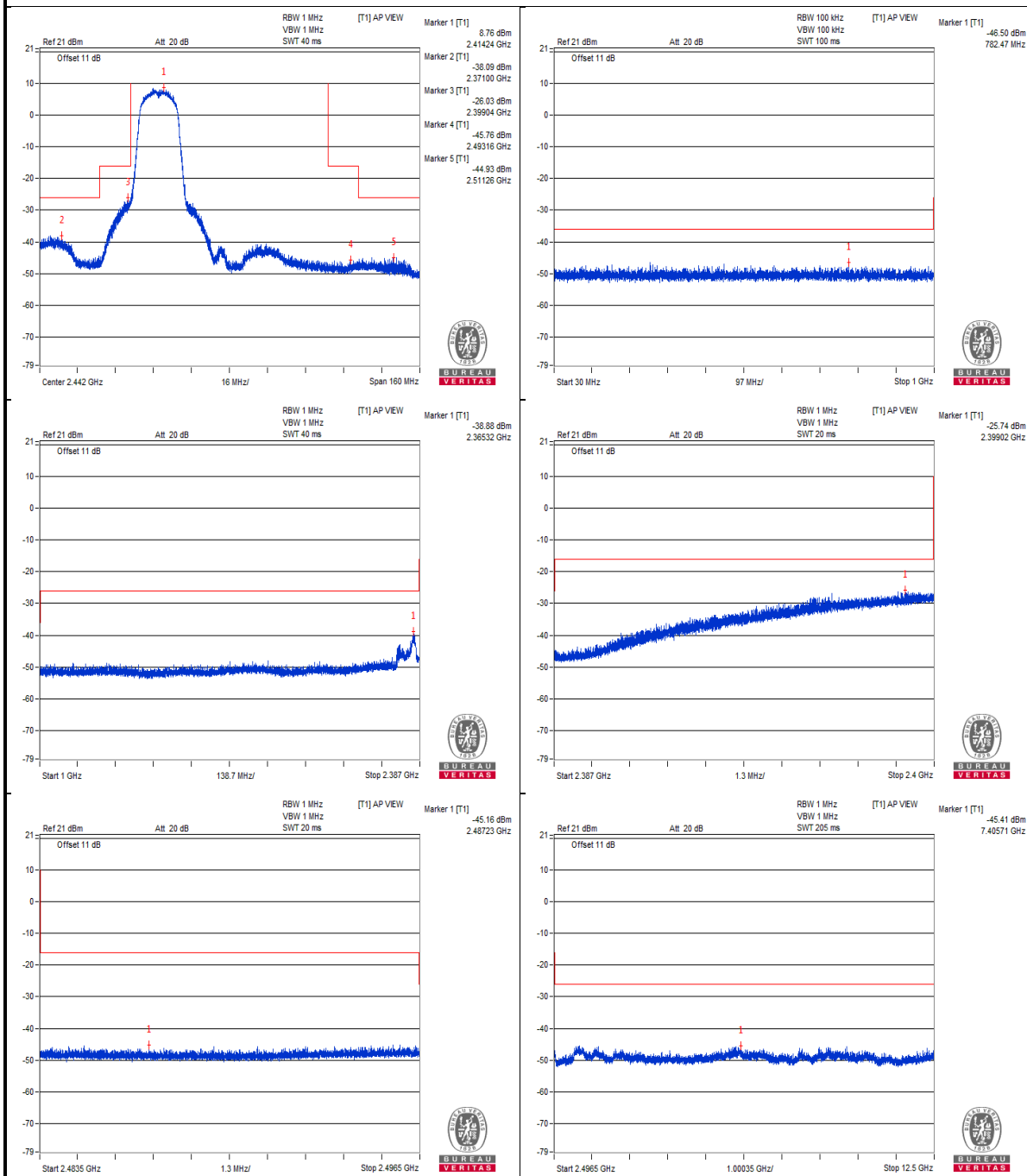
Environmental Conditions		25 deg.C, 60% RH					
Test Channel		CH1 (2412MHz)		CH7 (2442MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value	Frequency (MHz)	Measured Value		
V _{normal}	30.0MHz to 1000.0MHz	782.47	0.022uW	798.72	0.019uW	0.25 uW/100kHz	PASS
	1000.0MHz to 2387MHz	2365.32	0.129uW	2342.96	0.079uW	2.5 uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2399.02	2.666uW	2395.51	0.222uW	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2487.23	0.03uW	2488.32	0.098uW	25 uW/MHz	PASS
	2496.5MHz to 12500.0MHz	7405.71	0.028uW	2496.5	0.035uW	2.5 uW/MHz	PASS
V _{max}	30.0MHz to 1000.0MHz	806.24	0.021uW	993.45	0.02uW	0.25 uW/100kHz	PASS
	1000.0MHz to 2387MHz	2365.5	0.139uW	2344.17	0.077uW	2.5 uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2399.87	3.019uW	2399.35	0.198uW	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2493.99	0.032uW	2489.08	0.116uW	25 uW/MHz	PASS
	2496.5MHz to 12500.0MHz	3593.13	0.028uW	3102.96	0.03uW	2.5 uW/MHz	PASS
V _{min}	30.0MHz to 1000.0MHz	550.76	0.022uW	659.16	0.021uW	0.25 uW/100kHz	PASS
	1000.0MHz to 2387MHz	2369.48	0.137uW	2337.41	0.072uW	2.5 uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2398.93	2.588uW	2393.82	0.185uW	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2493.53	0.03uW	2490.11	0.1uW	25 uW/MHz	PASS
	2496.5MHz to 12500.0MHz	3116.71	0.029uW	4290.87	0.03uW	2.5 uW/MHz	PASS

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

Test Channel		CH13 (2472MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value		
V _{normal}	30.0MHz to 1000.0MHz	701.24	0.019uW	0.25 uW/ 100kHz	PASS
	1000.0MHz to 2387MHz	2375.55	0.1uW	2.5 uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2388.14	0.089uW	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2483.5	3.664uW	25 uW/MHz	PASS
	2496.5MHz to 12500.0MHz	2517.75	0.04uW	2.5 uW/MHz	PASS
V _{max}	30.0MHz to 1000.0MHz	862.38	0.019uW	0.25 uW/ 100kHz	PASS
	1000.0MHz to 2387MHz	2373.99	0.088uW	2.5 uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2388.9	0.074uW	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2483.82	3.793uW	25 uW/MHz	PASS
	2496.5MHz to 12500.0MHz	2511.5	0.052uW	2.5 uW/MHz	PASS
V _{min}	30.0MHz to 1000.0MHz	475.23	0.02uW	0.25 uW/ 100kHz	PASS
	1000.0MHz to 2387MHz	2370.52	0.112uW	2.5 uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2388.83	0.087uW	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2483.68	3.548uW	25 uW/MHz	PASS
	2496.5MHz to 12500.0MHz	2519	0.058uW	2.5 uW/MHz	PASS

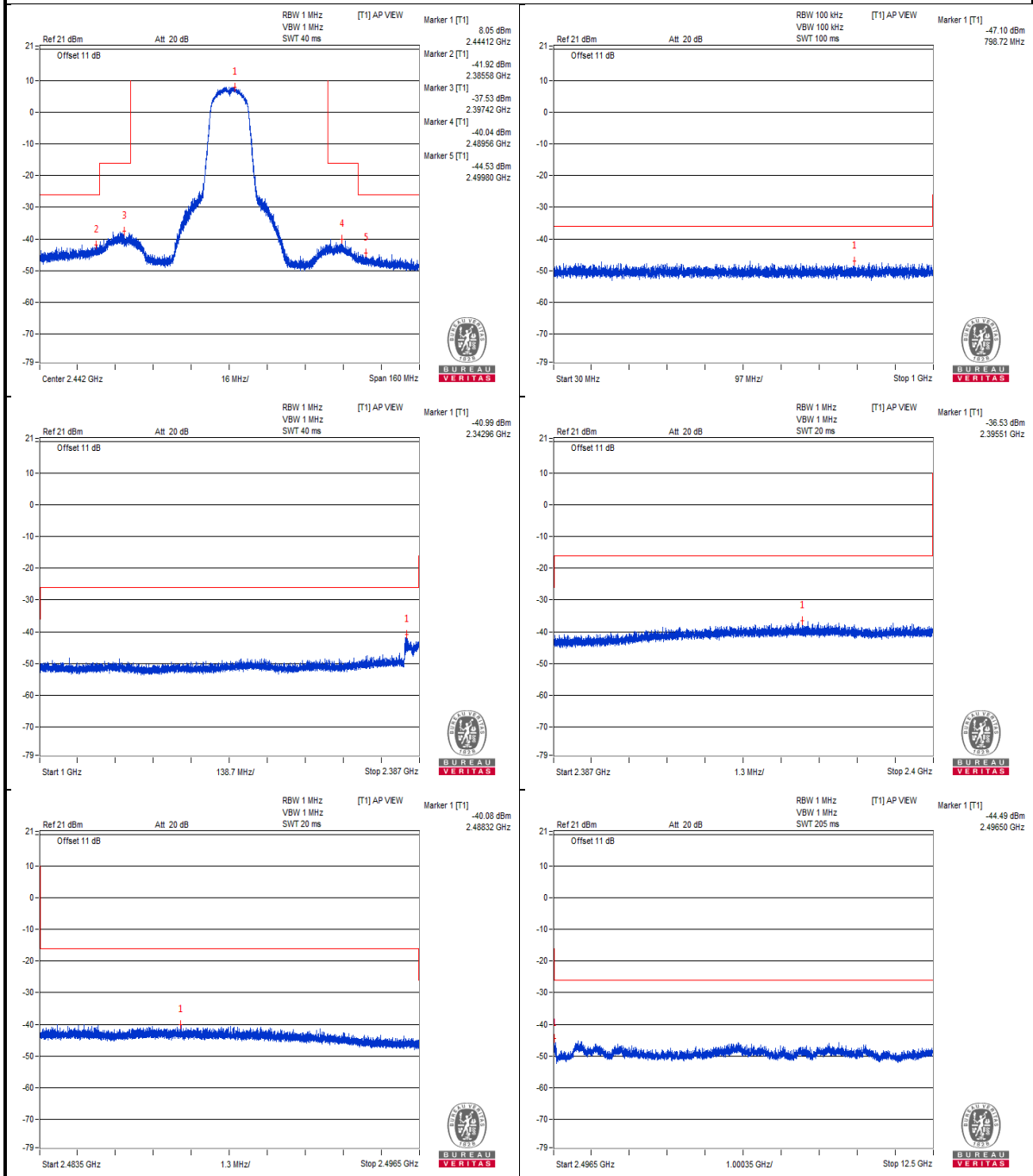
- Note: 1. The worst value in each frequency range v.s. each channel has been marked by boldface.
2. The spectrum plots are attached on the following pages.

Vnormal



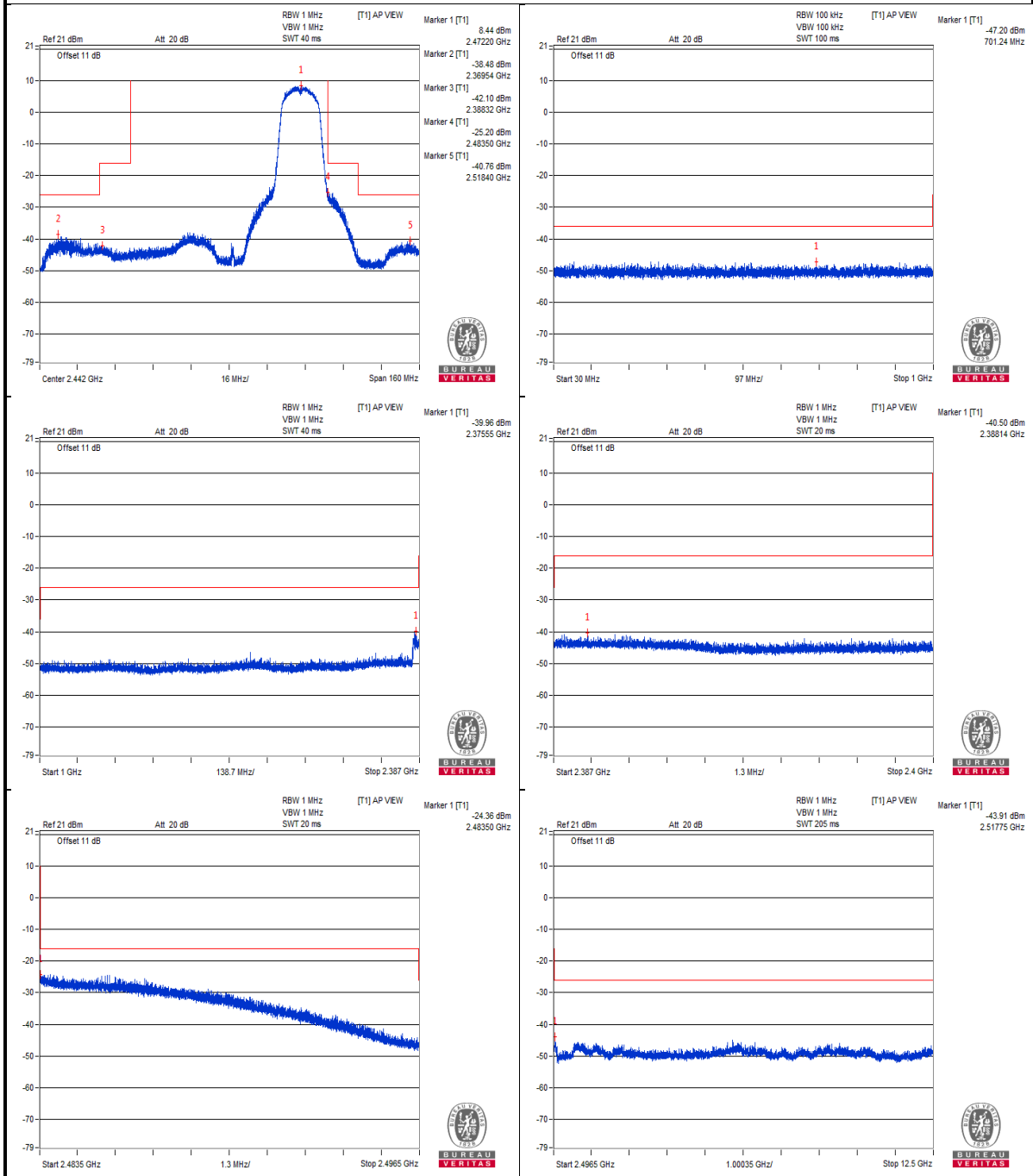
Channel 1

Vnormal



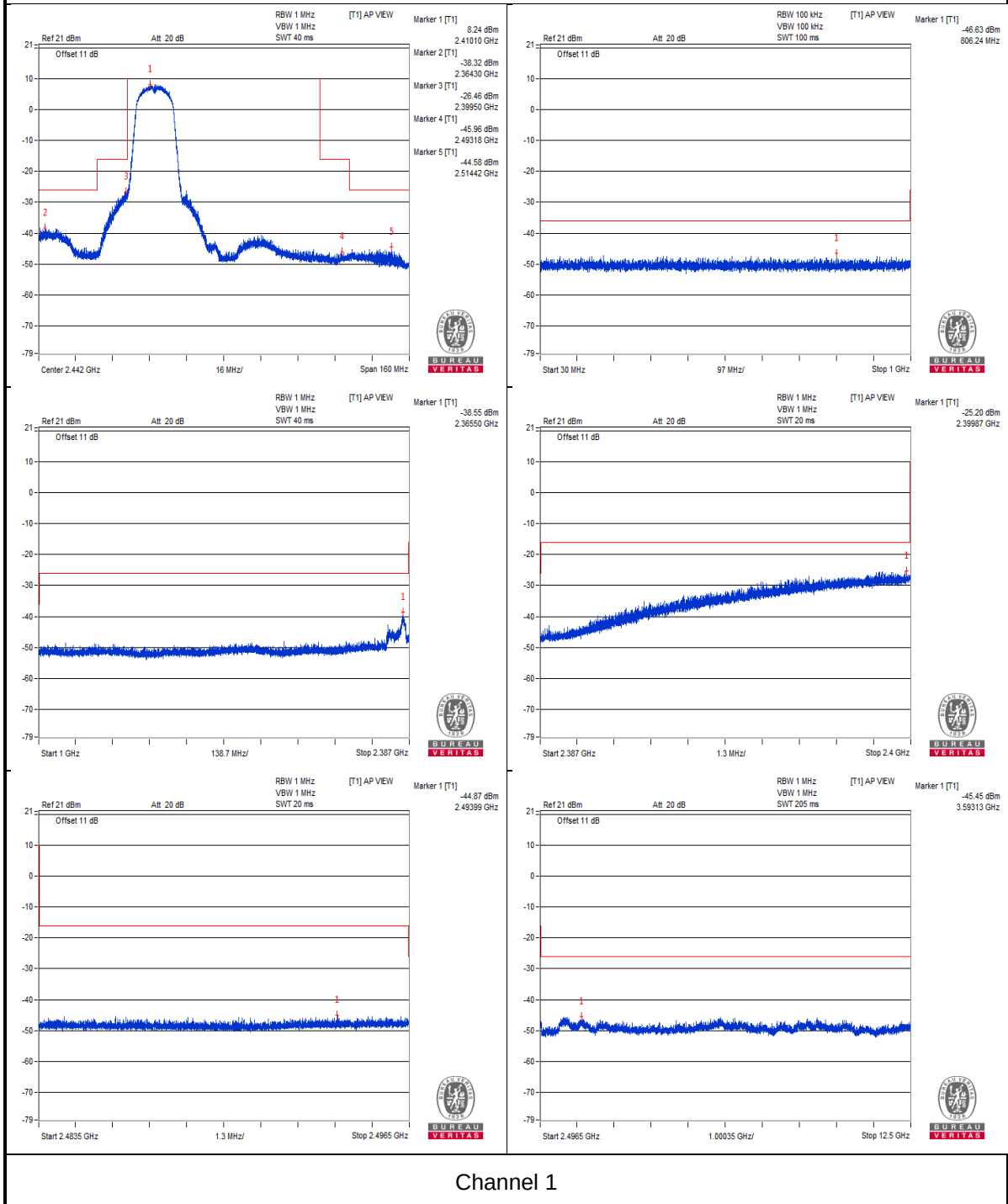
Channel 7

Vnormal

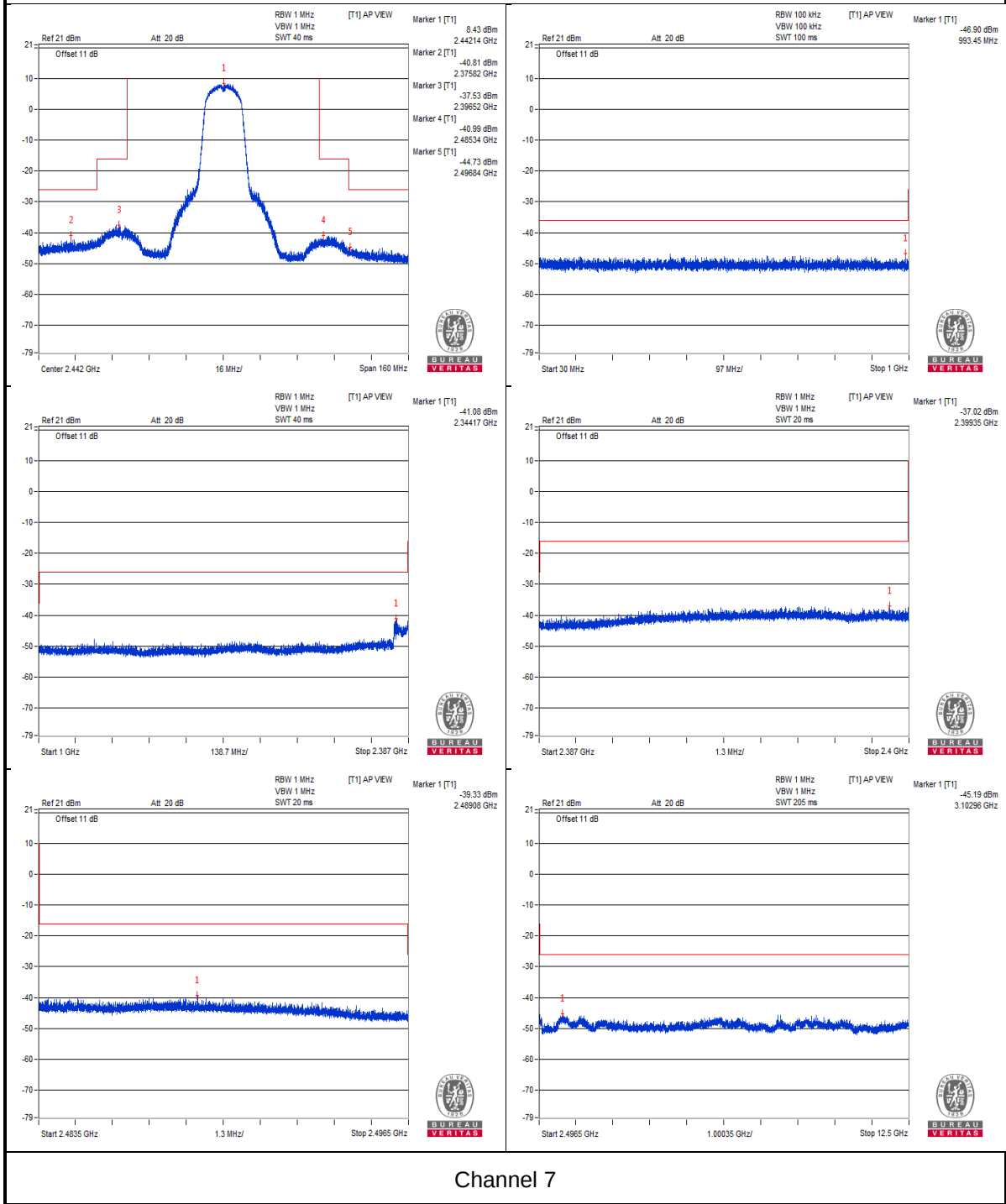


Channel 13

V+10%

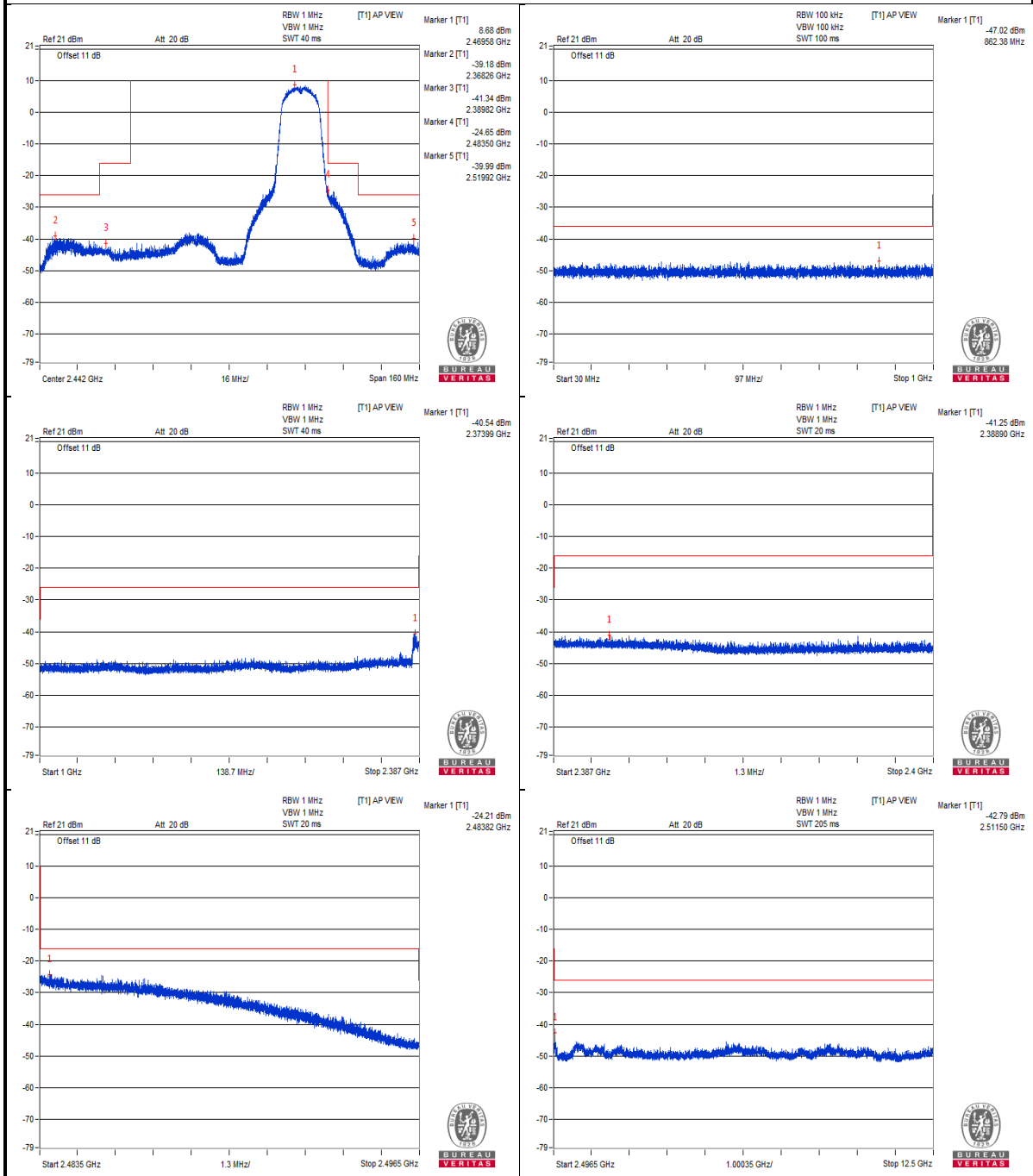


V+10%



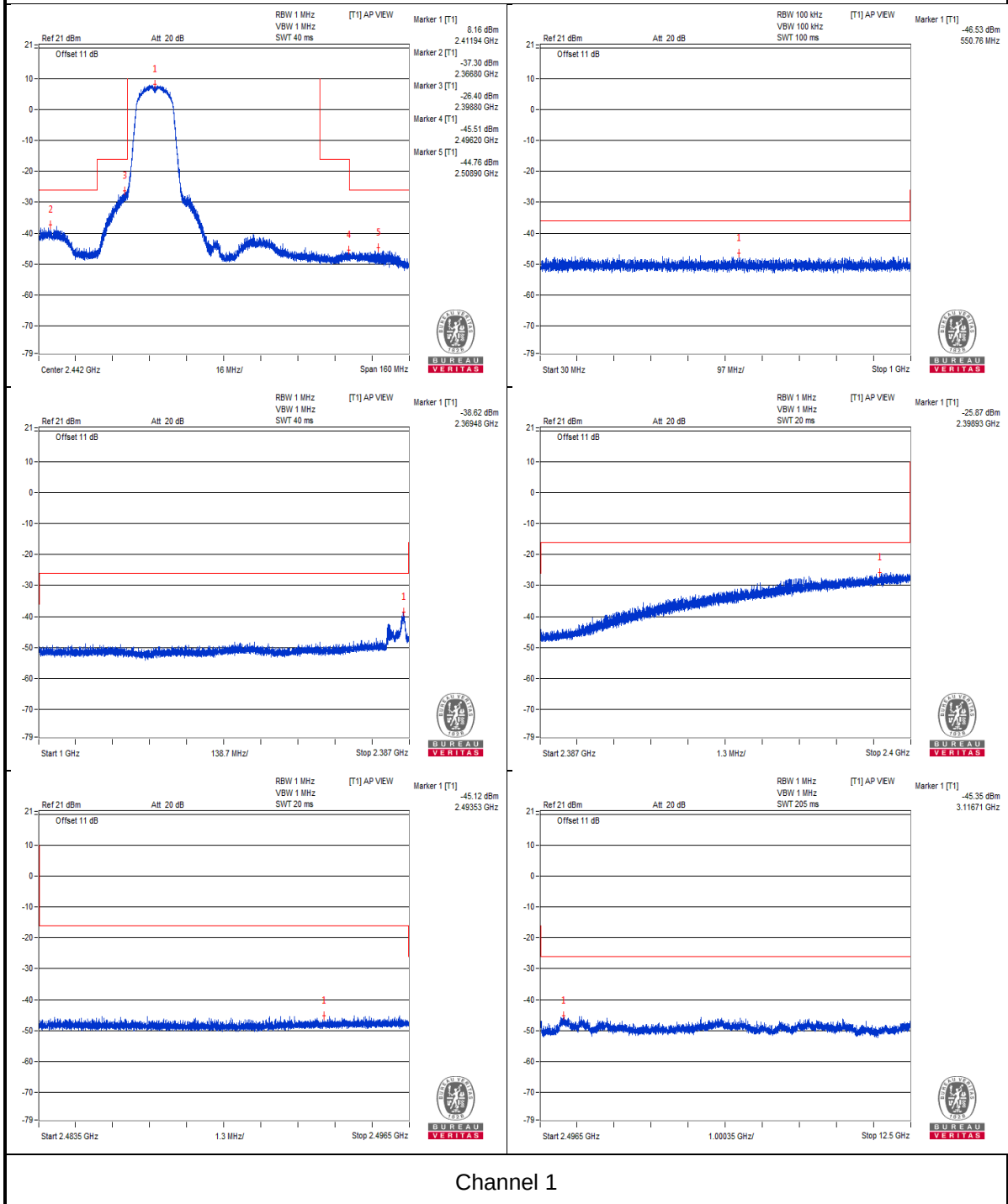
Channel 7

V+10%

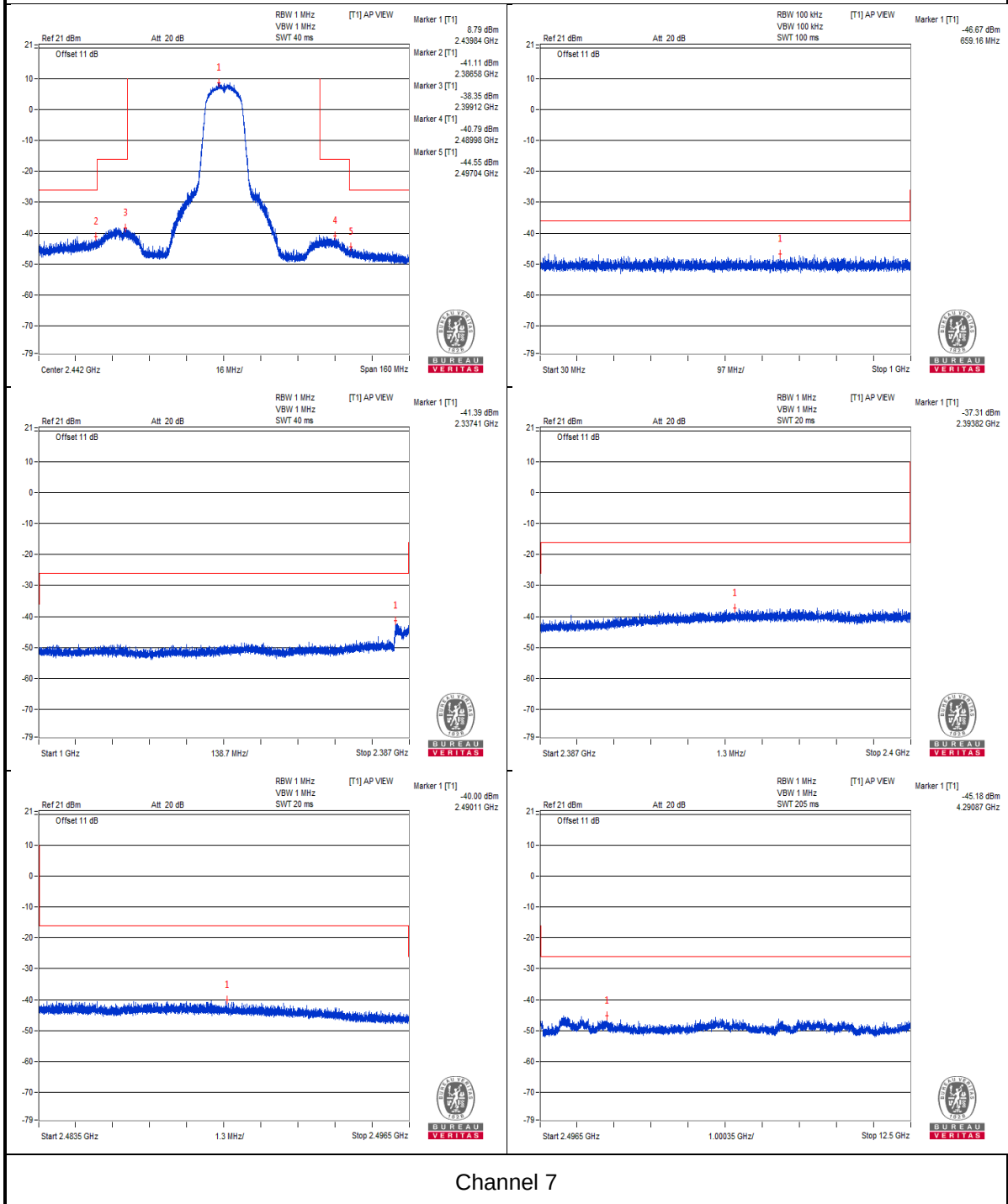


Channel 13

V-10%

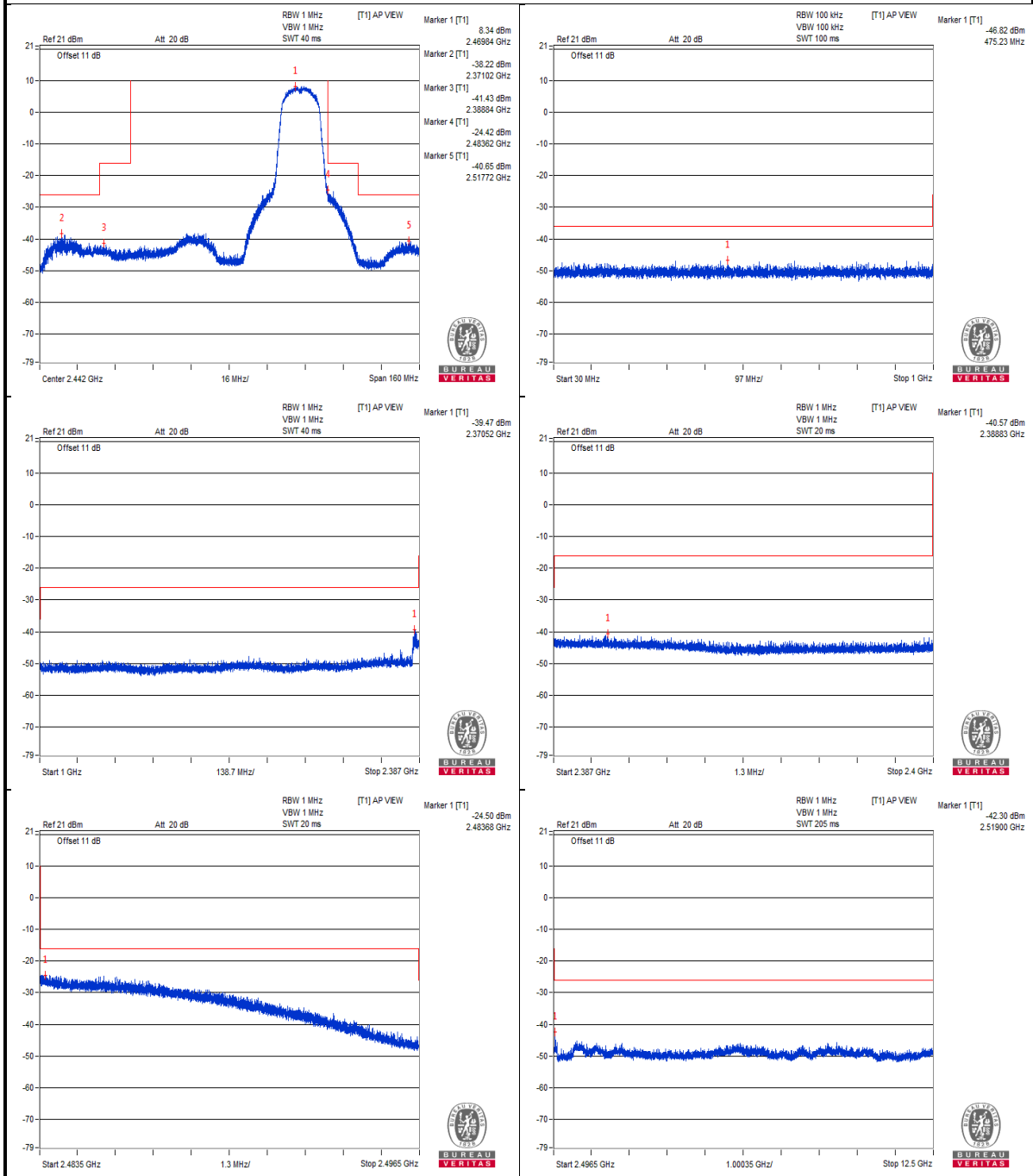


V-10%



Channel 7

V-10%



Channel 13

802.11n (HT20)

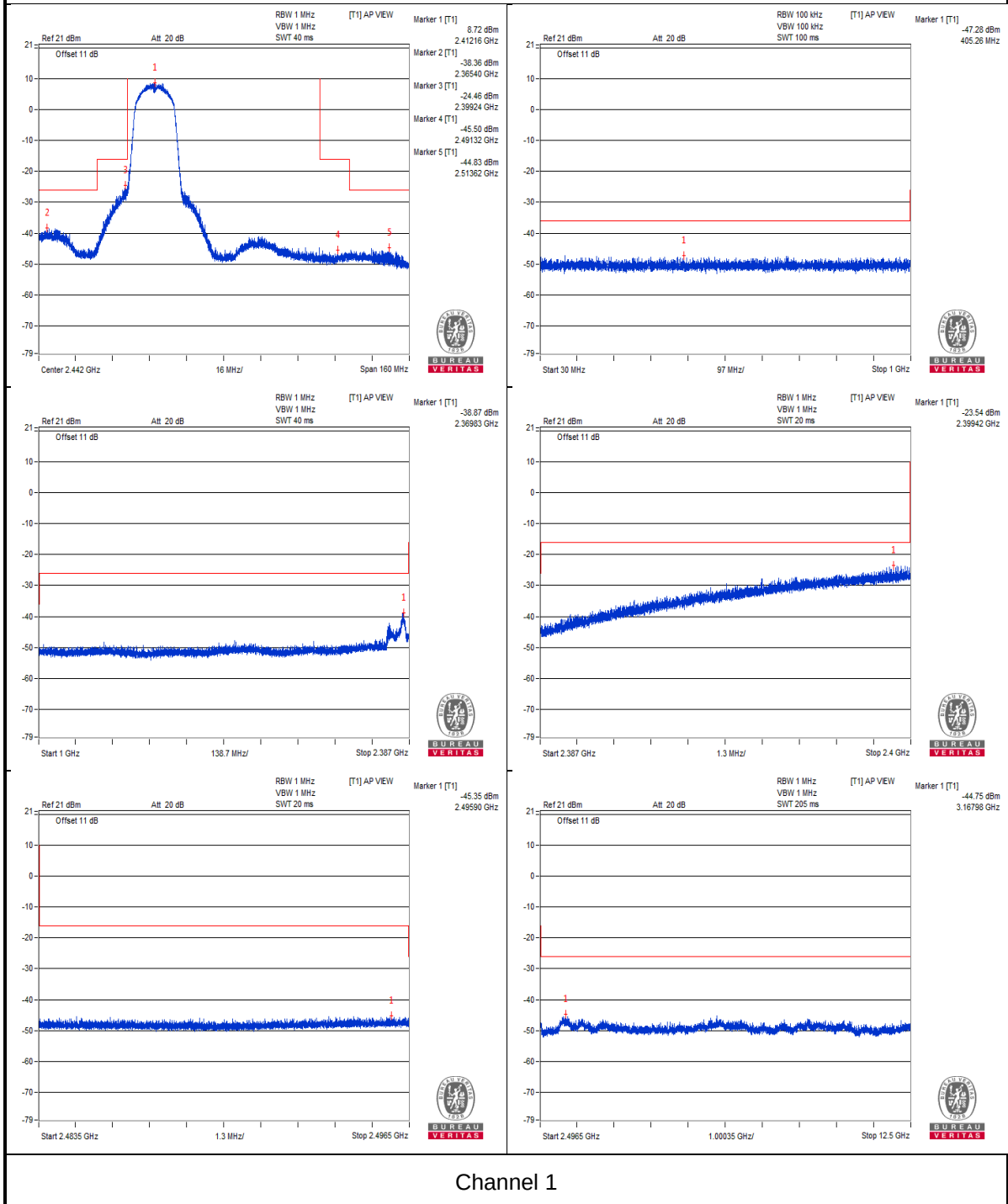
Environmental Conditions		25 deg.C, 60% RH					
Test Channel		CH1 (2412MHz)		CH7 (2442MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value	Frequency (MHz)	Measured Value		
V _{normal}	30.0MHz to 1000.0MHz	405.26	0.018uW	816.67	0.021uW	0.25 uW/100kHz	PASS
	1000.0MHz to 2387MHz	2369.83	0.129uW	2342.61	0.066uW	2.5 uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2399.42	4.425uW	2396.44	0.202uW	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2495.9	0.029uW	2489.25	0.099uW	25 uW/MHz	PASS
	2496.5MHz to 12500.0MHz	3167.98	0.033uW	3256.76	0.031uW	2.5 uW/MHz	PASS
V _{max}	30.0MHz to 1000.0MHz	553.92	0.023uW	266.07	0.019uW	0.25 uW/100kHz	PASS
	1000.0MHz to 2387MHz	2363.94	0.158uW	2343.65	0.072uW	2.5 uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2399.56	4.073uW	2397.1	0.207uW	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2493.13	0.032uW	2488.6	0.089uW	25 uW/MHz	PASS
	2496.5MHz to 12500.0MHz	3124.21	0.033uW	3109.21	0.029uW	2.5 uW/MHz	PASS
V _{min}	30.0MHz to 1000.0MHz	181.68	0.019uW	896.93	0.022uW	0.25 uW/100kHz	PASS
	1000.0MHz to 2387MHz	2365.32	0.135uW	2340.88	0.081uW	2.5 uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2399.39	4.295uW	2398.2	0.195uW	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2487.83	0.034uW	2487.61	0.099uW	25 uW/MHz	PASS
	2496.5MHz to 12500.0MHz	7350.69	0.026uW	2539.01	0.03uW	2.5 uW/MHz	PASS

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

Test Channel		CH13 (2472MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value		
V _{normal}	30.0MHz to 1000.0MHz	889.29	0.021uW	0.25 uW/ 100kHz	PASS
	1000.0MHz to 2387MHz	2371.56	0.177uW	2.5 uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2389.18	0.089uW	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2483.55	4.518uW	25 uW/MHz	PASS
	2496.5MHz to 12500.0MHz	2517.75	0.082uW	2.5 uW/MHz	PASS
V _{max}	30.0MHz to 1000.0MHz	298.81	0.02uW	0.25 uW/ 100kHz	PASS
	1000.0MHz to 2387MHz	2371.91	0.1uW	2.5 uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2389.81	0.08uW	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2483.51	4.055uW	25 uW/MHz	PASS
	2496.5MHz to 12500.0MHz	2520.25	0.053uW	2.5 uW/MHz	PASS
V _{min}	30.0MHz to 1000.0MHz	950.53	0.021uW	0.25 uW/ 100kHz	PASS
	1000.0MHz to 2387MHz	2370.87	0.092uW	2.5 uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2396.14	0.077uW	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2483.65	4.345uW	25 uW/MHz	PASS
	2496.5MHz to 12500.0MHz	2514	0.047uW	2.5 uW/MHz	PASS

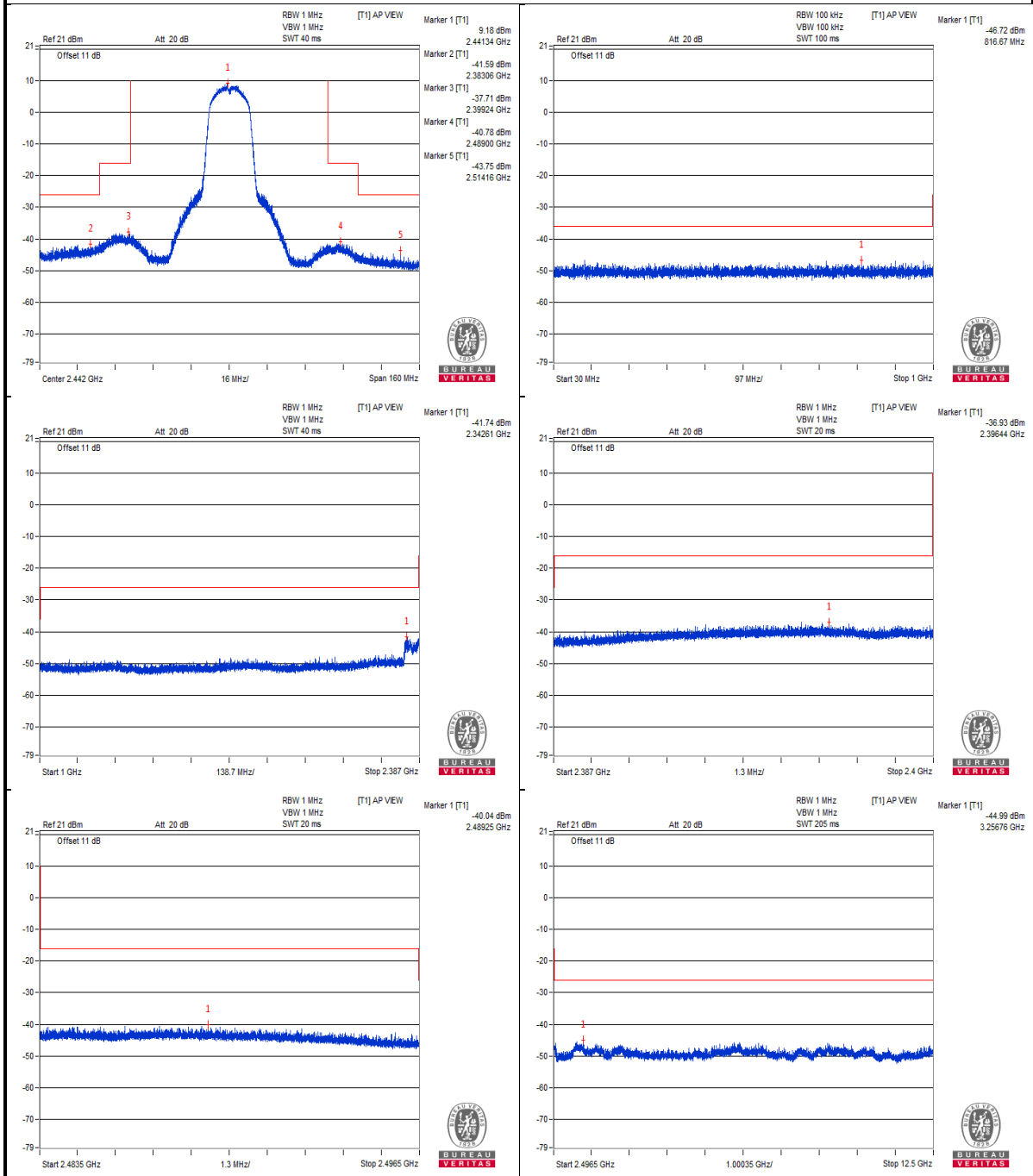
- Note: 1. The worst value in each frequency range v.s. each channel has been marked by boldface.
2. The spectrum plots are attached on the following pages.

Vnormal



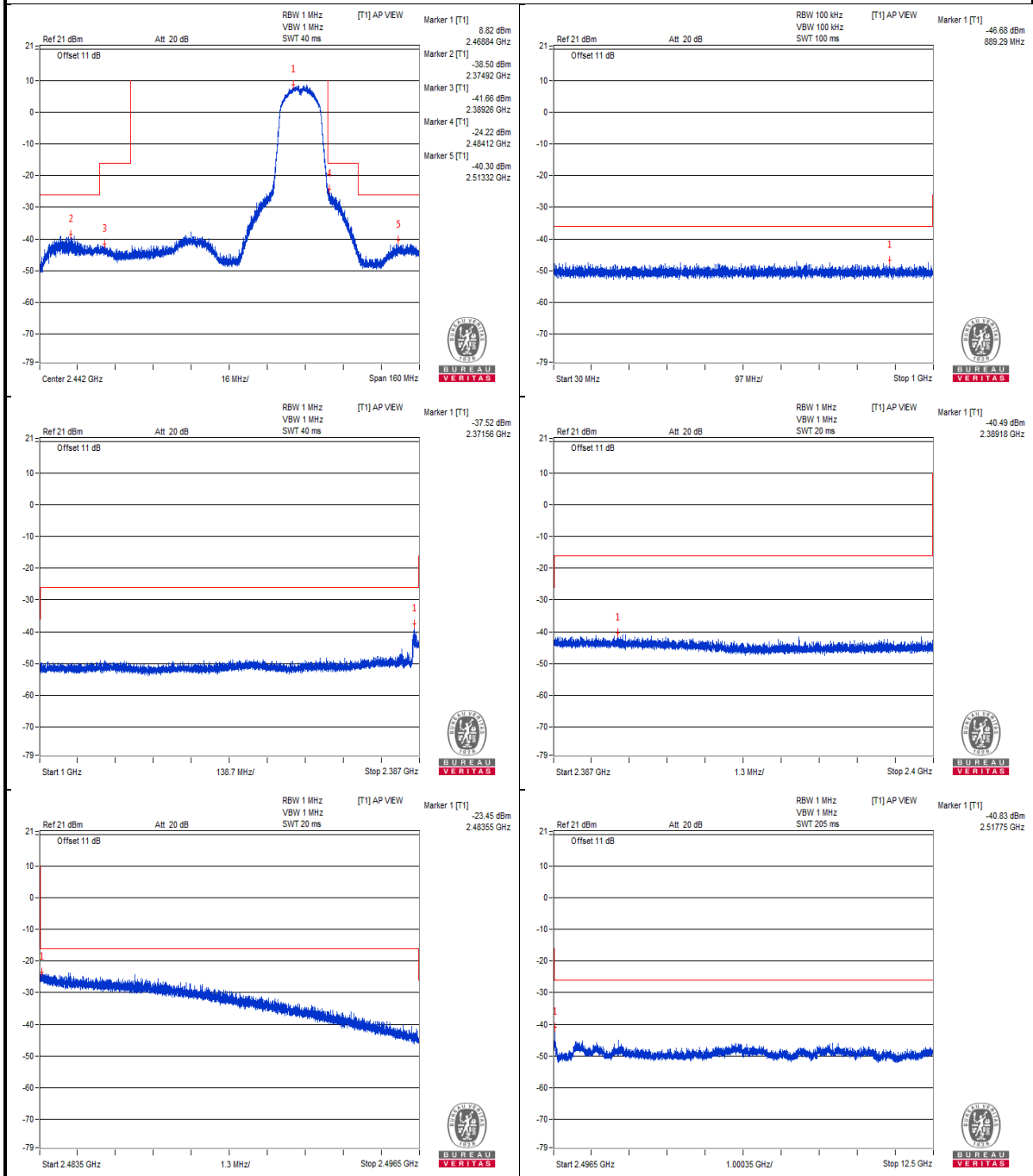
Channel 1

Vnormal



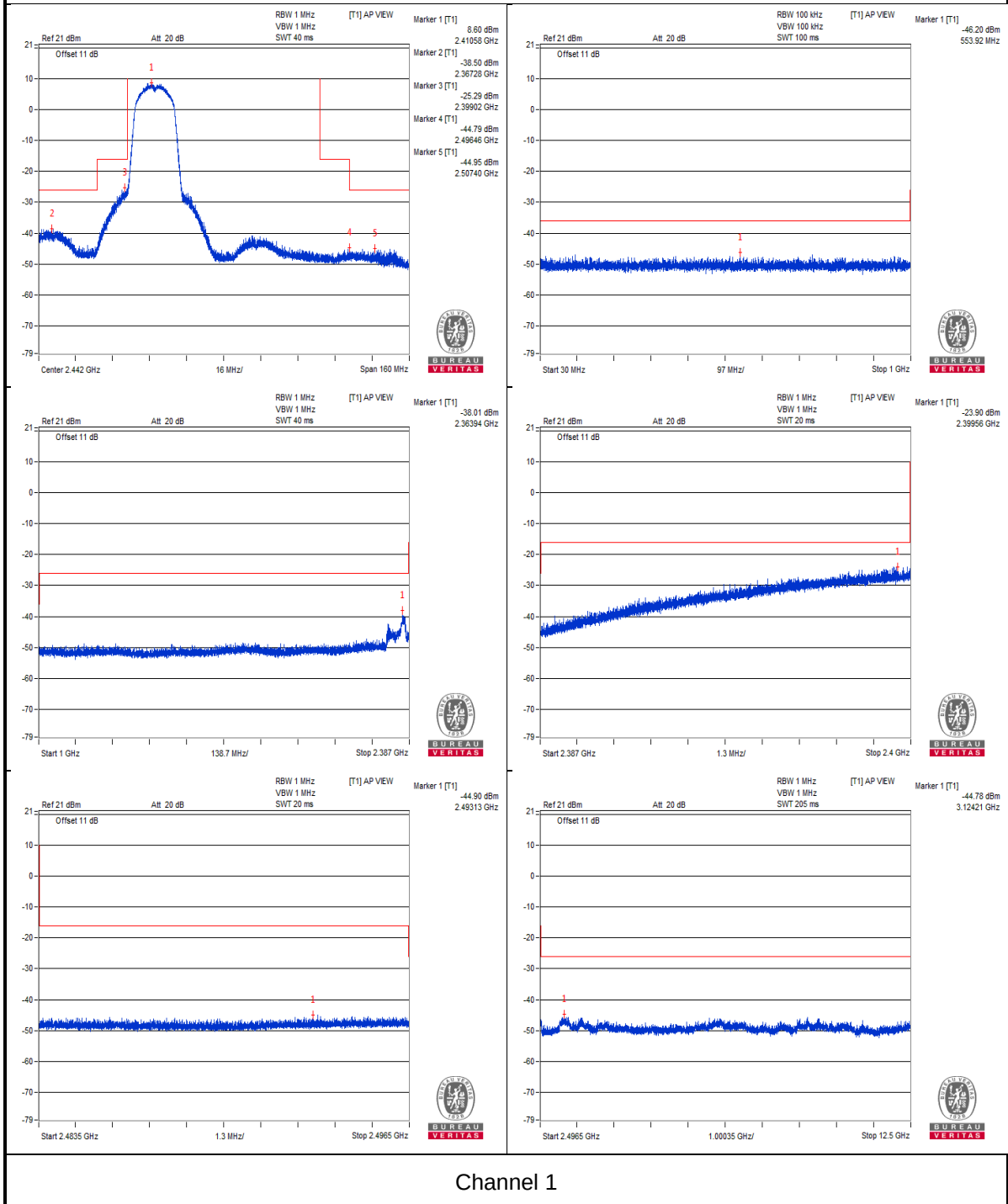
Channel 7

Vnormal

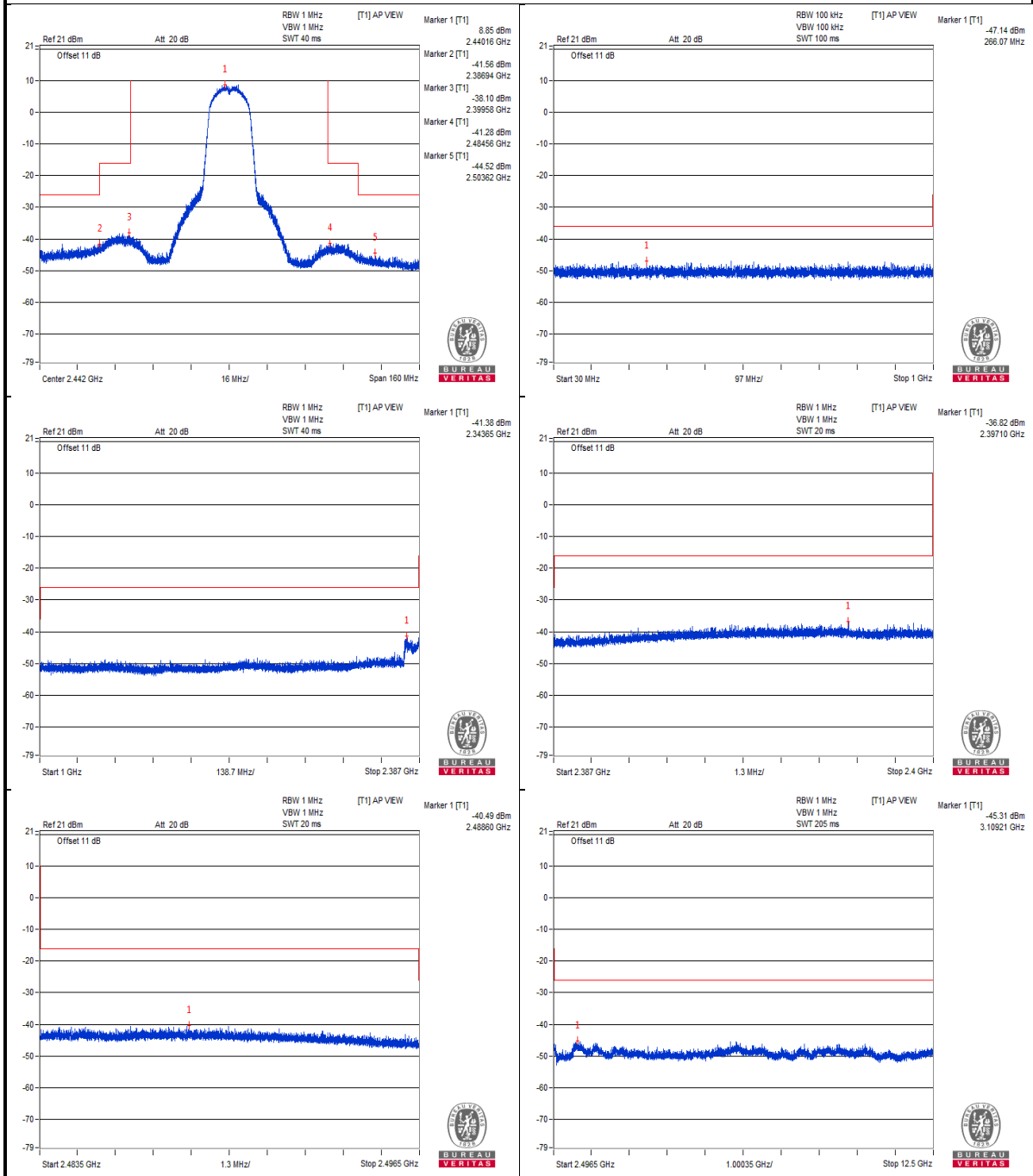


Channel 13

V+10%

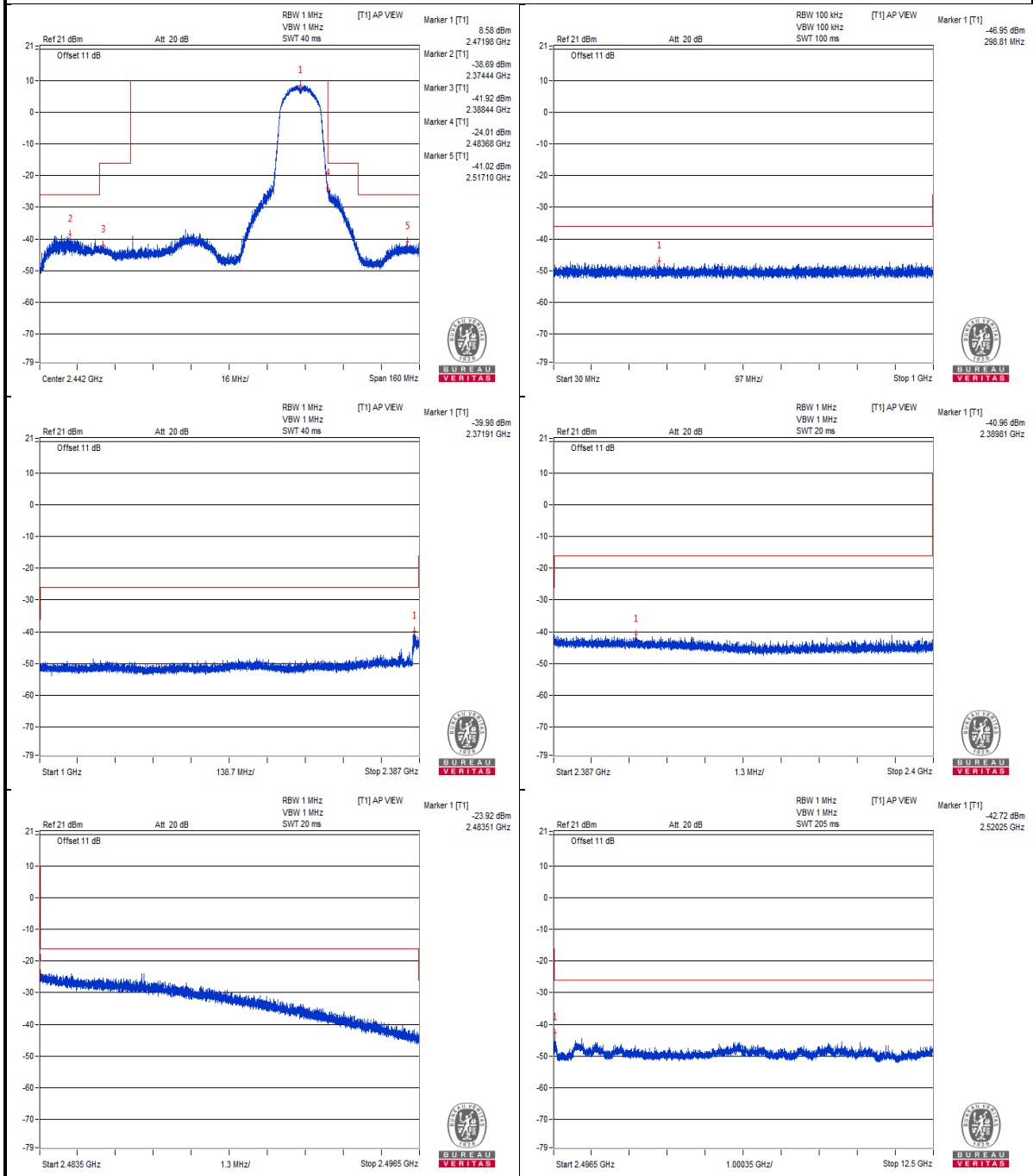


V+10%



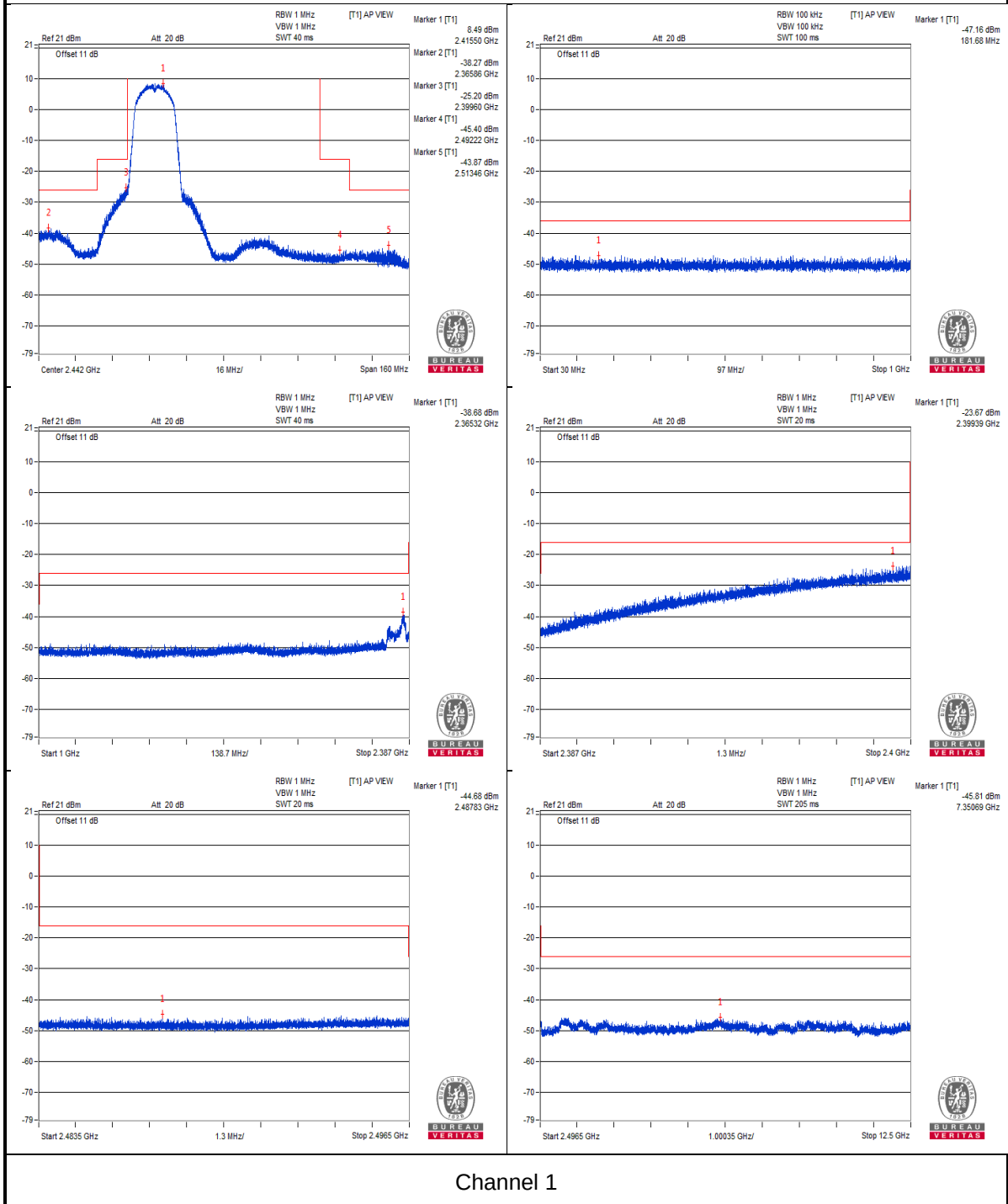
Channel 7

V+10%

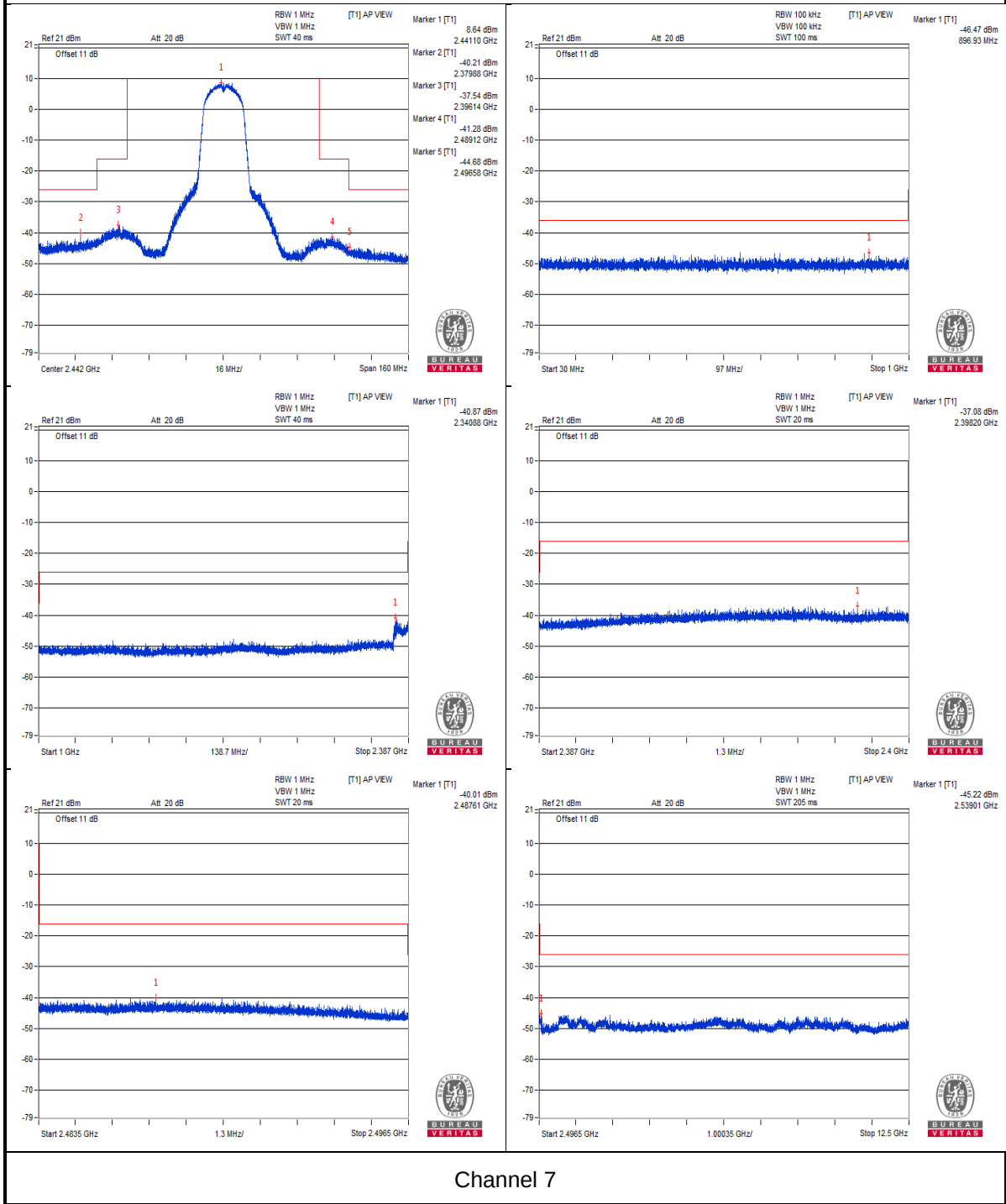


Channel 13

V-10%

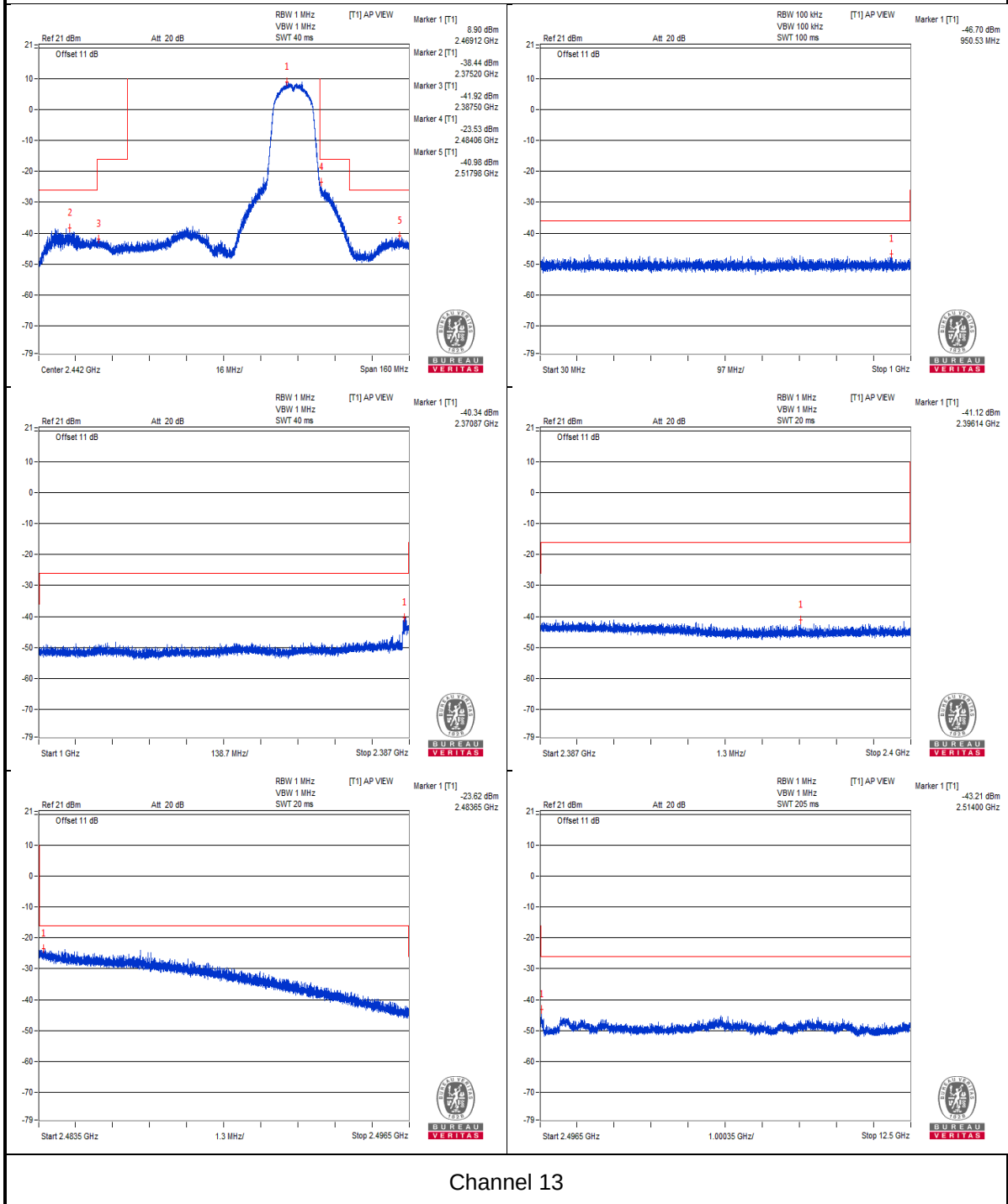


V-10%



Channel 7

V-10%



Channel 13

4.5 Antenna Power Measurement

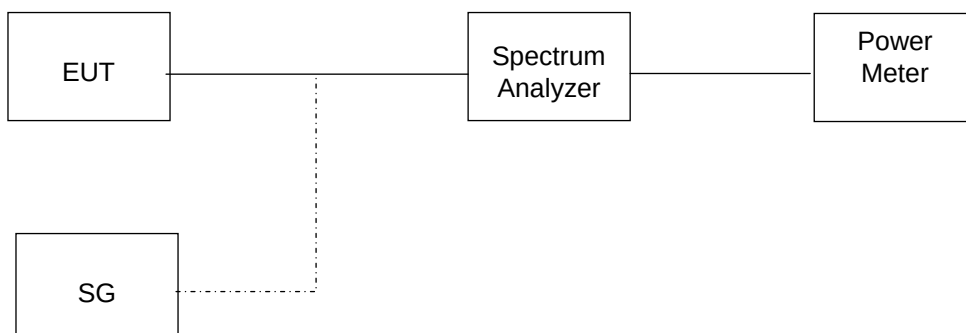
4.5.1 Limits of Antenna Power

Modulation System	Frequency Band Used	Antenna Power (Max.)	EIRP (Max.)	
			Omni-Directional Case	Directional Case
DS	2400 – 2483.5 MHz	10mW/MHz	12.14 dBm/MHz (16.368 mW/MHz)	22.14 dBm/MHz (163.68 mW/MHz)
OFDM (Note 1)	2400 – 2483.5 MHz	10mW/MHz	12.14 dBm/MHz (16.368 mW/MHz)	22.14 dBm/MHz (163.68 mW/MHz)
OFDM (Note 2)	2400 – 2483.5 MHz	5mW/MHz	9.14dBm/MHz (8.203mW/MHz)	19.14dBm/MHz (82.03mW/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



4.5.3 Test Results

802.11b

Environmental Conditions	25 deg.C, 60% RH			
Channel Number	Frequency (MHz)	Conducted RF Output Power Density (mW/MHz)		
		V _{normal}	V _{max}	V _{min}
1	2412	9.775	9.797	9.842
7	2442	9.707	9.53	9.956
13	2472	9.663	9.888	9.956
Max. Limit (mW/MHz)		10		
Rated Power		10		
Tolerance of Antenna Power		2 ~ 12		

PIFA antenna with antenna gain: 1.62 dBi

Environmental Conditions	25 deg.C, 60% RH			
Channel Number	Frequency (MHz)	Radiated RF Output Power Density (mW/MHz)		
		V _{normal}	V _{max}	V _{min}
1	2412	14.194	14.226	14.292
7	2442	14.096	13.839	14.457
13	2472	14.032	14.358	14.457
Max. EIRP Limit (mW/MHz)		16.368		

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 + Antenna Gain.

802.11g

Environmental Conditions	25 deg.C, 60% RH			
Channel Number	Frequency (MHz)	Conducted RF Output Power Density (mW/MHz)		
		V _{normal}	V _{max}	V _{min}
1	2412	9.356	9.618	9.249
7	2442	9.378	9.707	8.997
13	2472	9.663	9.552	9.685
Max. Limit (mW/MHz)		10		
Rated Power		10		
Tolerance of Antenna Power		2 ~ 12		

PIFA antenna with antenna gain: 1.62 dBi

Environmental Conditions	25 deg.C, 60% RH			
Channel Number	Frequency (MHz)	Radiated RF Output Power Density (mW/MHz)		
		V _{normal}	V _{max}	V _{min}
1	2412	13.586	13.966	13.431
7	2442	13.618	14.096	13.065
13	2472	14.032	13.871	14.064
Max. EIRP Limit (mW/MHz)		16.368		

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 + Antenna Gain.

802.11n (HT20)

Environmental Conditions	25 deg.C, 60% RH			
Channel Number	Frequency (MHz)	Conducted RF Output Power Density (mW/MHz)		
		V _{normal}	V _{max}	V _{min}
1	2412	9.64	9.249	9.73
7	2442	9.443	9.27	9.552
13	2472	9.752	9.552	9.552
Max. Limit (mW/MHz)		10		
Rated Power		10		
Tolerance of Antenna Power		2 ~ 12		

PIFA antenna with antenna gain: 1.62 dBi

Environmental Conditions	25 deg.C, 60% RH			
Channel Number	Frequency (MHz)	Radiated RF Output Power Density (mW/MHz)		
		V _{normal}	V _{max}	V _{min}
1	2412	13.998	13.431	14.129
7	2442	13.712	13.461	13.871
13	2472	14.161	13.871	13.871
Max. EIRP Limit (mW/MHz)		16.368		

Note: 1. The radiated RF output power density is a “calculated” value derived from the conducted value.

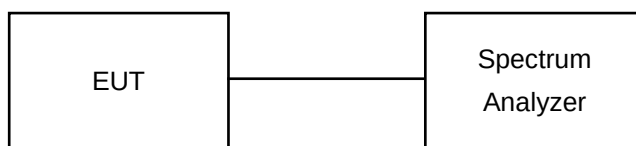
2. Formula: Radiated RF output power density = Conducted RF output power density + Antenna Gain.

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

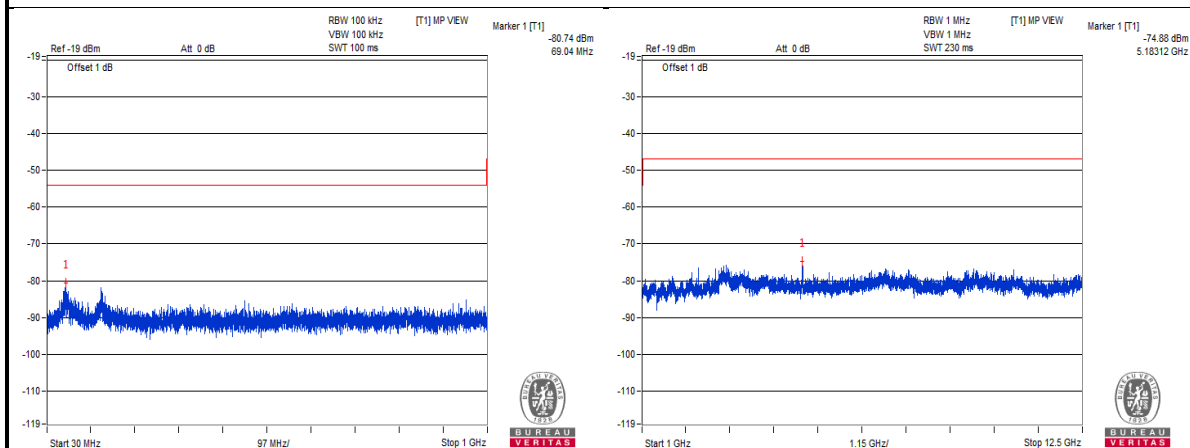


4.6.3 Test Result

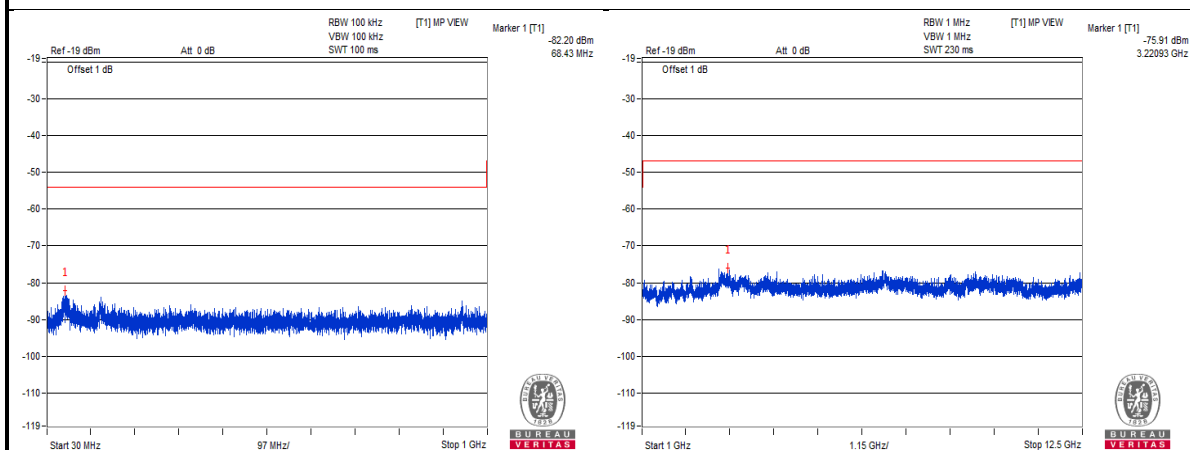
Environmental Conditions		25 deg.C, 60% RH					
Test Channel		Channel 1 (2412MHz)		Channel 7 (2442MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value	Frequency (MHz)	Measured Value		
V _{normal}	Below 1GHz	69.04	0.008433nW	68.43	0.006026nW	4nW/100kHz	PASS
	Above 1GHz	5183.12	0.032509nW	3220.93	0.025645nW	20nW/MHz	PASS
V+10%	Below 1GHz	68.92	0.007656nW	70.86	0.00871nW	4nW/100kHz	PASS
	Above 1GHz	5187.43	0.037068nW	3126.06	0.024322nW	20nW/MHz	PASS
V-10%	Below 1GHz	69.16	0.007396nW	69.64	0.007129nW	4nW/100kHz	PASS
	Above 1GHz	3229.56	0.030409nW	5193.18	0.027925nW	20nW/MHz	PASS
Test Channel		Channel 13 (2472MHz)				Limit	Result
Test Condition	Frequency Range	Frequency (MHz)		Measured Value			
V _{normal}	Below 1GHz	102.02		0.003365nW		4nW/100kHz	PASS
	Above 1GHz	3070		0.02799nW		20nW/MHz	PASS
V+10%	Below 1GHz	70.25		0.003819nW		4nW/100kHz	PASS
	Above 1GHz	2985.18		0.025351nW		20nW/MHz	PASS
V-10%	Below 1GHz	148.09		0.004819nW		4nW/100kHz	PASS
	Above 1GHz	5295.25		0.023227nW		20nW/MHz	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.

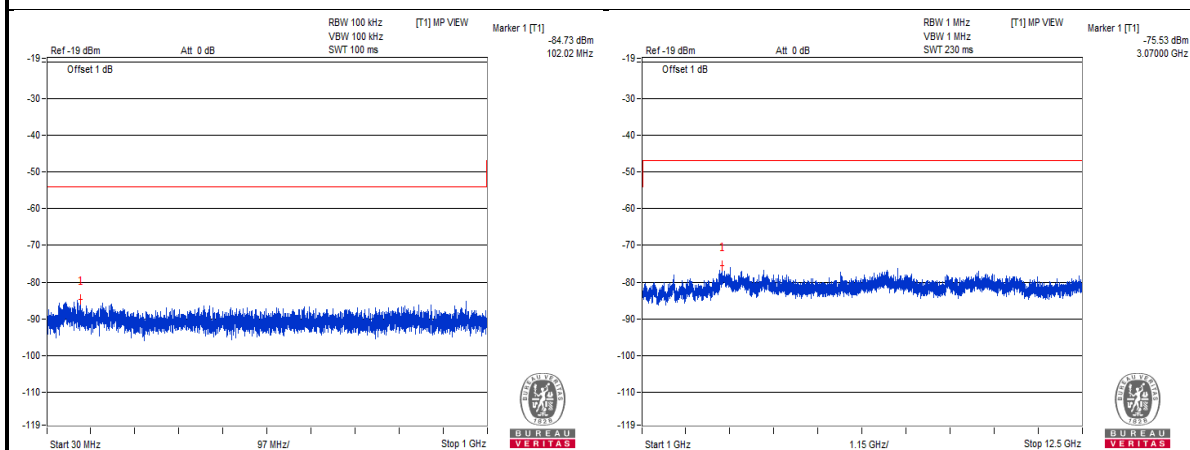
V_{normal}



Channel 1

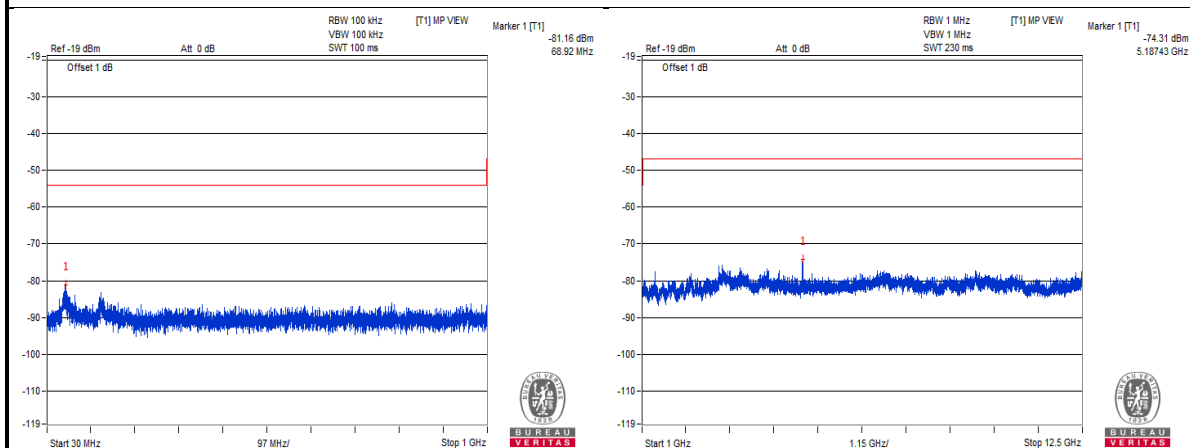


Channel 7

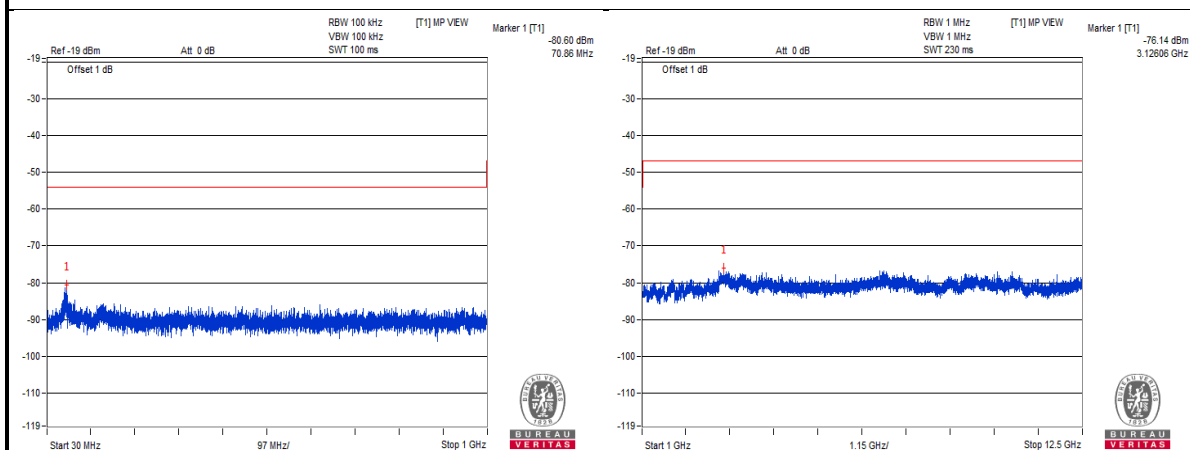


Channel 13

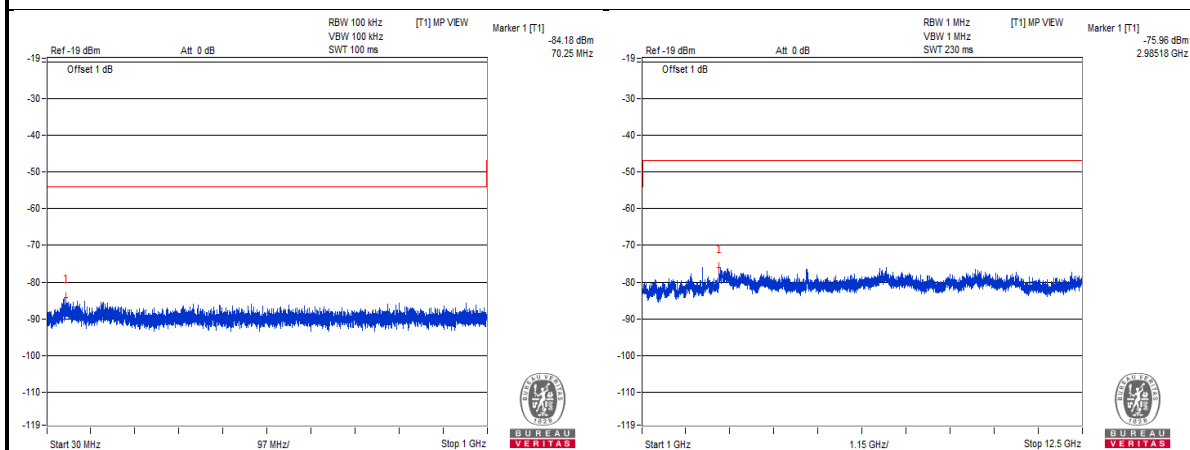
V+10%



Channel 1

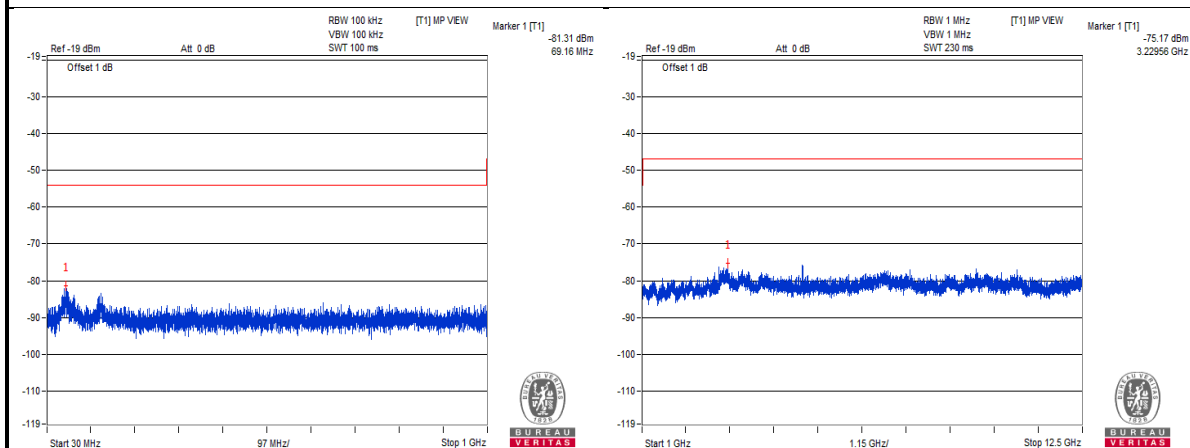


Channel 7

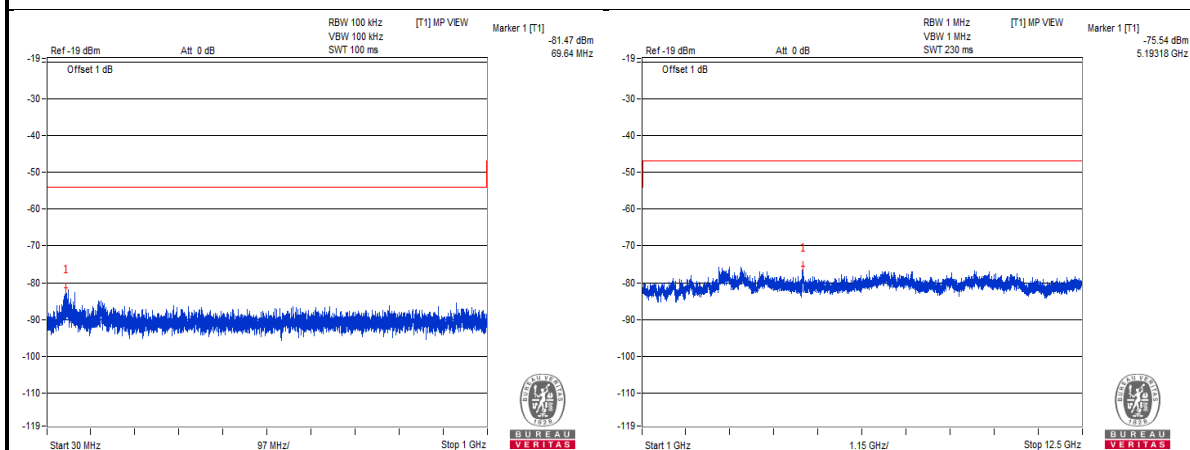


Channel 13

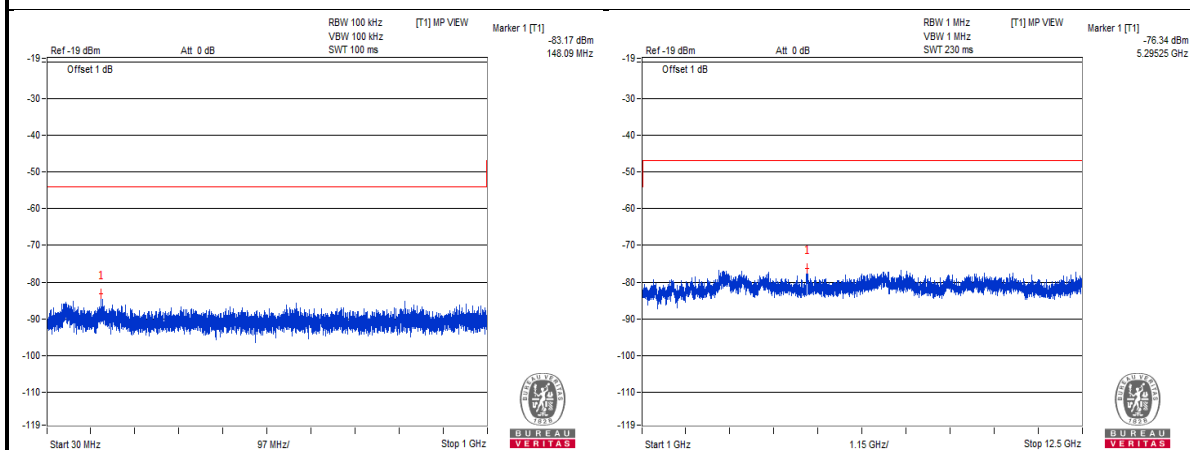
V-10%



Channel 1



Channel 7



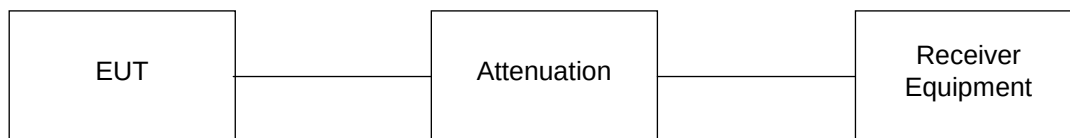
Channel 13

4.7 Interference Prevention Function

4.7.1 Limits of Interference Prevention Function

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

4.7.2 Test Setup



4.7.3 Test Results

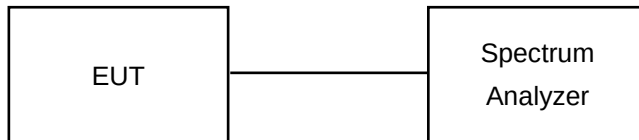
Environmental Conditions	25 deg.C, 60% RH
Link Mode	Test Result
WiFi	PASS

4.8 Number of Carriers within 1 MHz Bandwidth in OFDM

4.8.1 Limit of Number of Carriers

For each 1MHz bandwidth in OFDM, there should be at least 1 carrier

4.8.2 Test Setup



4.8.3 Test Result

About OFDM Technical, one OFDM Channel will have 52 sub-carriers. At present, we observe this product via the spectrum, and we know that there are 3 carriers in 1 MHz bandwidth in OFDM.

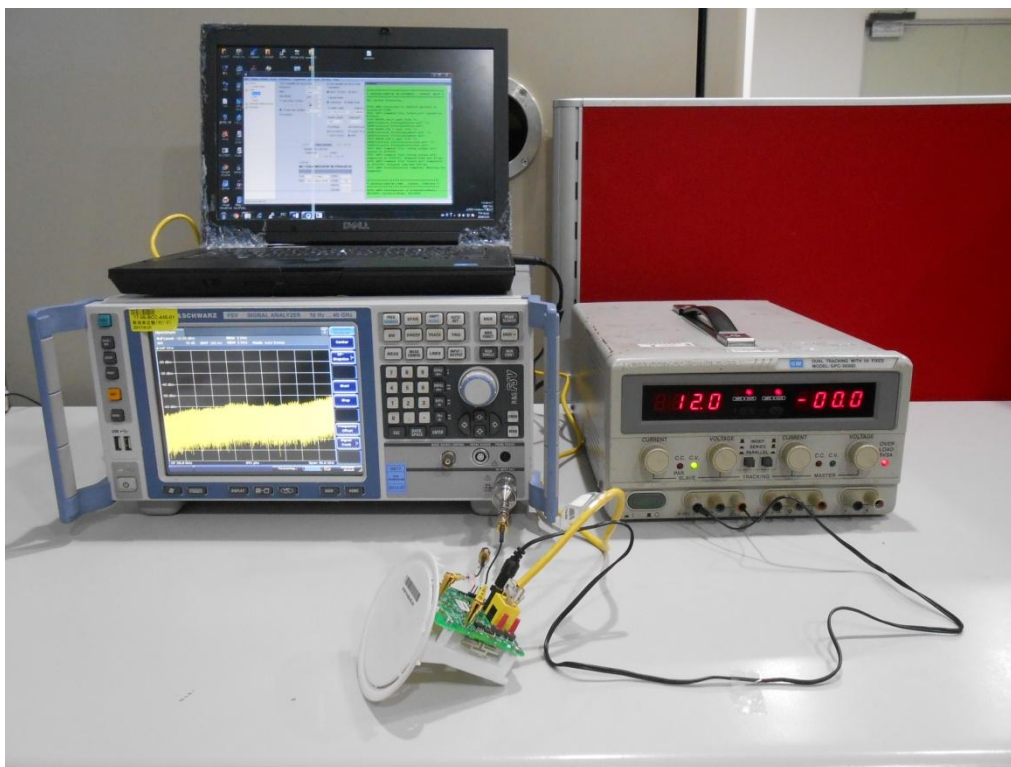
5 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL	CALIBRATION AUTHORITY
Spectrum Analyzer R&S	FSV40	100964	July 1, 2017	June 30, 2018	ETC
ESG Vector signal generator Agilent	E4438C	MY47271330 506 602 UNJ	Oct, 11, 2017	Oct. 10, 2018	ETC
Detector Narda	4503A	0306	NA	NA	NA
Power Meter Anritsu	ML2495A	1014008	May 11, 2017	May 10, 2018	ETC
Power Sensor Anritsu	MA2411B	0917122	May 11, 2017	May 10, 2018	ETC
Digital Oscilloscope R&S	RTO1012	300053	June 28, 2017	June 27, 2018	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	325	31130711WS	May 29, 2017	May 28, 2018	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: Mar. 13, 2018.

6 Photographs of the Test Configuration



Appendix - Information on 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:

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Fax: 886-2-26051924

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Email: service.adt@tw.bureauveritas.com

Web Site: www.bureauveritas-adt.com

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

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