

Radio Test Report (BT-LE)

Report No.: RJ180430E08F-3

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



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Release Control Record

Issue No.	Description	Date Issued
RJ180430E08F-3	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)	4.3	Spurious emissions	C
Transmitting Equipment				
F	--	4.4	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)	4.5	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)	4.4	Antenna power	C
--	3.6 (2)	4.4	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)	--	Spreading bandwidth	NA
--	3.2 (9)	--	Spreading factor	NA
--	3.2 (11)	--	Frequency retention time (FH employed)	NA
--	3.4.1 (1)	4.6	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 (BT-LE)

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
Modulation Technology	DTS
Transfer Rate	Up to 1Mbps
Operating Frequency	2.402 ~ 2.480GHz
Number of Channel	40
Rated RF Output Power	2 mW
Conducted RF Output Power	1.274 mW
Radiated RF Output Power	3.795 mW
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 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

40 channels are provided for BT-LE mode:

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

Note: 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:

Channel	Power Setting
0	Default
19	Default
39	Default

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

Environmental Conditions		25 deg.C, 60% RH					
Channel	Frequency (MHz)	V _{normal}		V _{max.}		V _{min.}	
		Carrier frequency (MHz)	Frequency tolerance (ppm)	Carrier frequency (MHz)	Frequency tolerance (ppm)	Carrier frequency (MHz)	Frequency tolerance (ppm)
0	2402	2401.989280	-4.462	2401.989279	-4.463	2401.989279	-4.463
19	2440	2439.989061	-4.483	2439.989090	-4.471	2439.989119	-4.459
39	2480	2479.988914	-4.470	2479.988914	-4.470	2479.988914	-4.470

4.2 Occupied Bandwidth Measurement (99% power bandwidth)

4.2.1 Limits of Occupied Bandwidth Measurement

Item	Limit
Occupied bandwidth	<26MHz

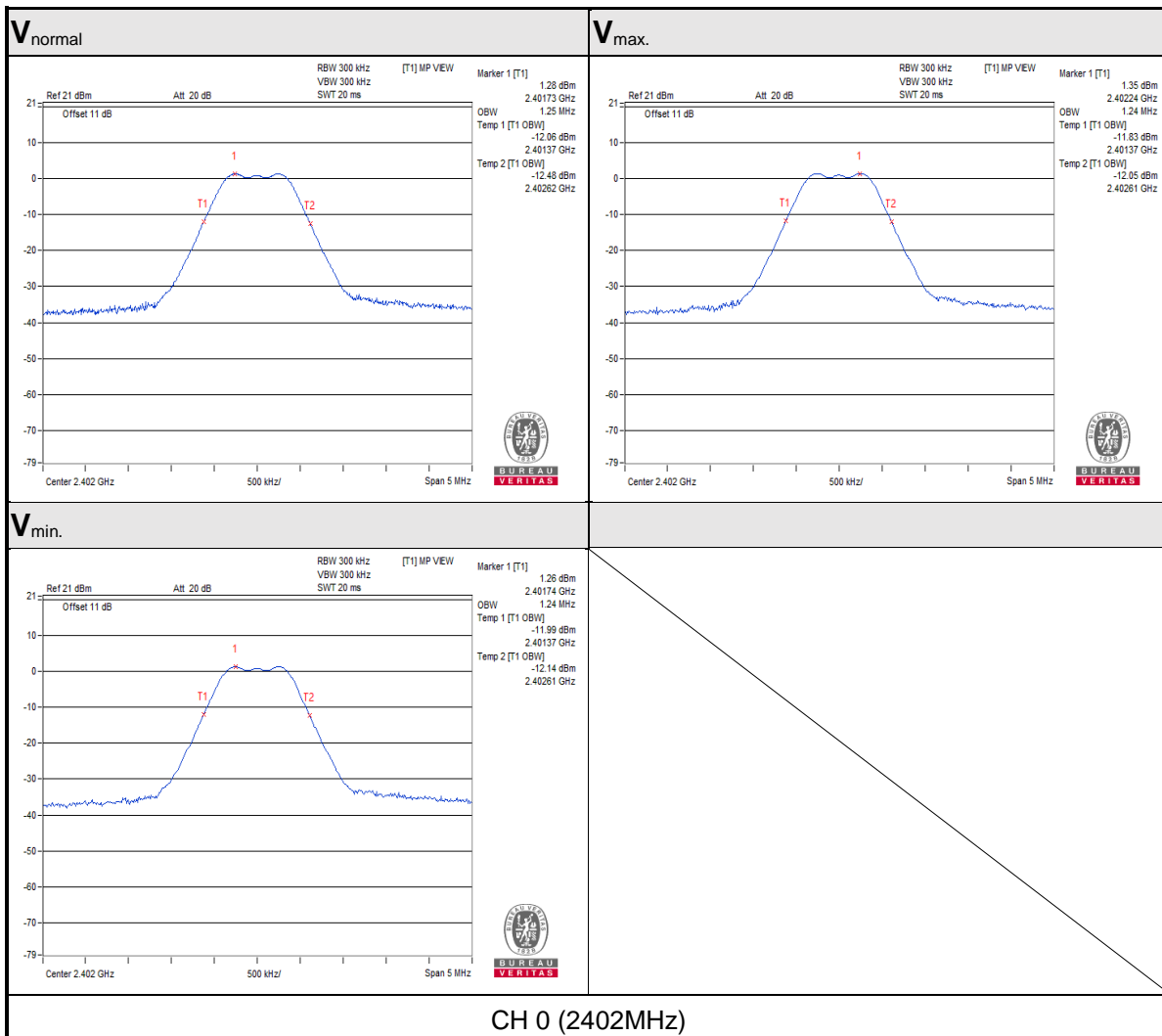
4.2.2 Test Setup



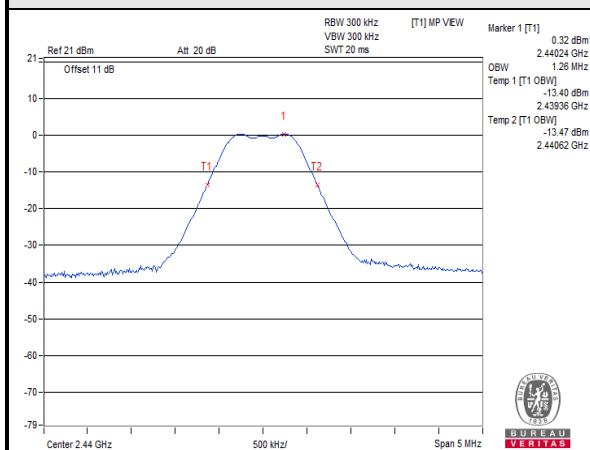
4.2.3 Test Results

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)
0	2402	1.25	1.24	1.24
19	2440	1.26	1.26	1.25
39	2480	1.24	1.26	1.26

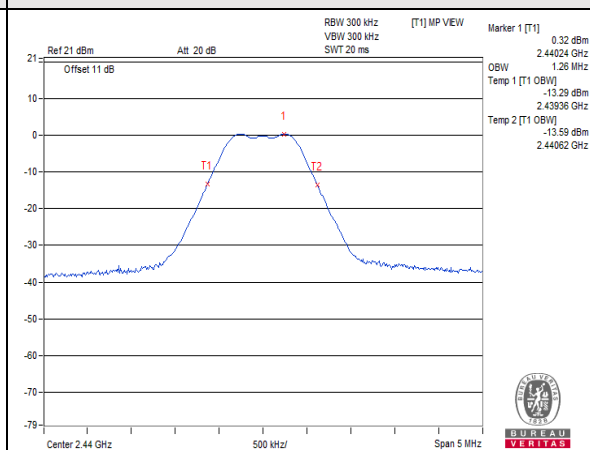
Note: 1. For the test plots please refer to the below pages.



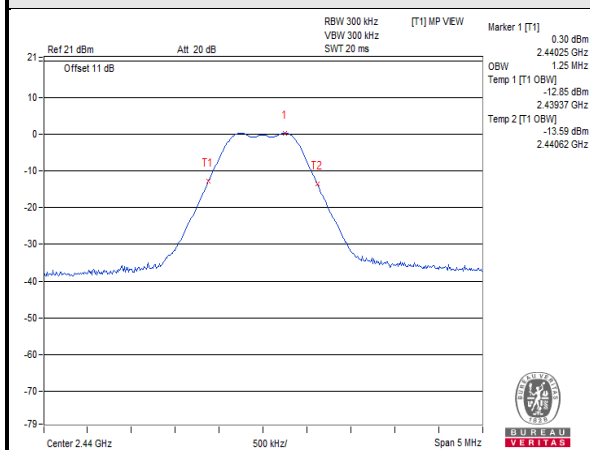
V_{normal}



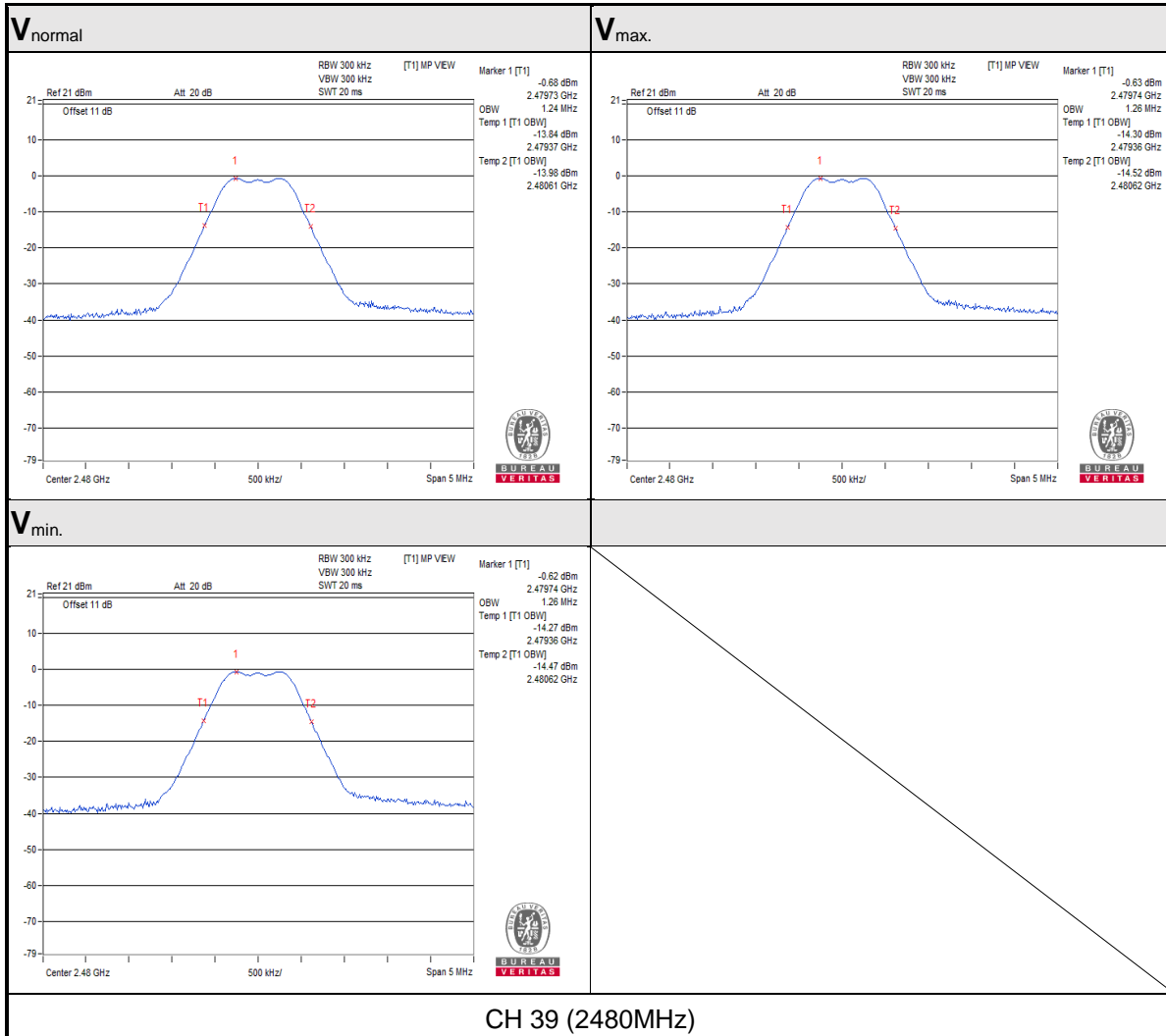
V_{max.}



V_{min.}



CH 19 (2440MHz)



4.3 Spurious Emissions for Transmitter Measurement

4.3.1 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	$\leq 2.5 \mu\text{W}/\text{MHz}$

4.3.2 Test Setup



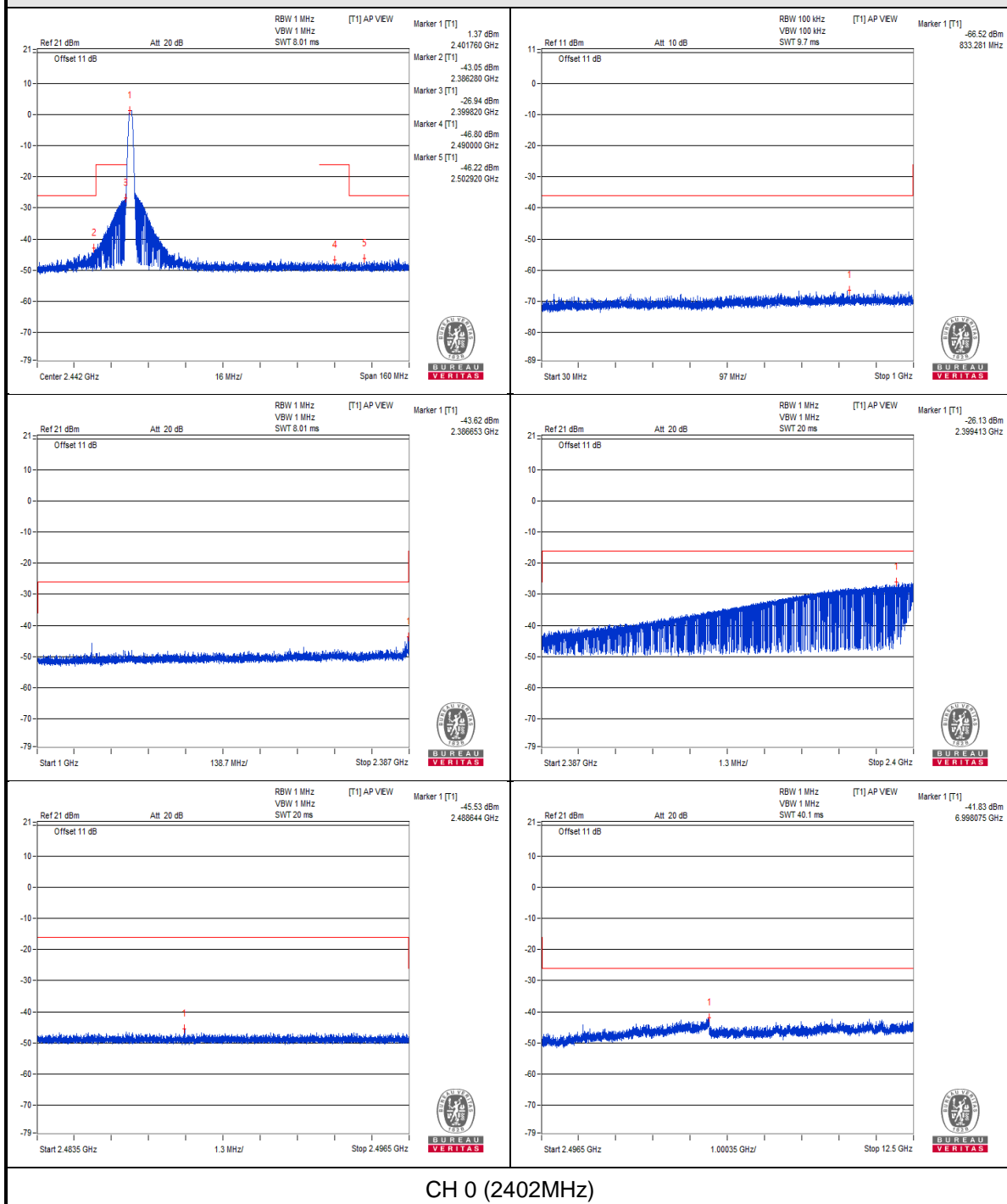
4.3.3 Test Results

TEST CHANNEL		CH 0 (2402MHz)			
TEST CONDITION	FREQUENCY RANGE(MHz)	FREQUENCY (MHz)	MEASURE. VALUE(uW)	LIMIT (uW)	RESULT
V_{normal}	30MHz to 1000MHz	833.281	0.000223	0.25	PASS
	1000MHz to 2387MHz	2386.653	0.043451	2.5	PASS
	2387MHz to 2400MHz	2399.413	2.437811	25	PASS
	2483.5MHz to 2496.5MHz	2488.644	0.027990	25	PASS
	2496.5MHz to 12500MHz	6998.075	0.065615	2.5	PASS
V_{max.}	30MHz to 1000MHz	589.447	0.000209	0.25	PASS
	1000MHz to 2387MHz	2386.826	0.048306	2.5	PASS
	2387MHz to 2400MHz	2399.715	2.588213	25	PASS
	2483.5MHz to 2496.5MHz	2487.478	0.025704	25	PASS
	2496.5MHz to 12500MHz	11345.846	0.073451	2.5	PASS
V_{min.}	30MHz to 1000MHz	999.515	0.000225	0.25	PASS
	1000MHz to 2387MHz	2386.653	0.043251	2.5	PASS
	2387MHz to 2400MHz	2399.920	2.477422	25	PASS
	2483.5MHz to 2496.5MHz	2493.948	0.023121	25	PASS
	2496.5MHz to 12500MHz	6989.321	0.067453	2.5	PASS
TEST CHANNEL		CH 19 (2440MHz)			
V_{normal}	30MHz to 1000MHz	748.406	0.000209	0.25	PASS
	1000MHz to 2387MHz	1220.012	0.024889	2.5	PASS
	2387MHz to 2400MHz	2387.440	0.024831	25	PASS
	2483.5MHz to 2496.5MHz	2490.988	0.024378	25	PASS
	2496.5MHz to 12500MHz	6970.565	0.068234	2.5	PASS
V_{max.}	30MHz to 1000MHz	746.830	0.000245	0.25	PASS
	1000MHz to 2387MHz	1219.839	0.025823	2.5	PASS
	2387MHz to 2400MHz	2397.609	0.022542	25	PASS
	2483.5MHz to 2496.5MHz	2485.609	0.025410	25	PASS
	2496.5MHz to 12500MHz	6938.054	0.068707	2.5	PASS
V_{min.}	30MHz to 1000MHz	746.102	0.000370	0.25	PASS
	1000MHz to 2387MHz	1220.012	0.031189	2.5	PASS
	2387MHz to 2400MHz	2399.886	0.023388	25	PASS
	2483.5MHz to 2496.5MHz	2492.483	0.022961	25	PASS
	2496.5MHz to 12500MHz	6993.073	0.060814	2.5	PASS

TEST CHANNEL		CH 39 (2480MHz)			
TEST CONDITION	FREQUENCY RANGE(MHz)	FREQUENCY (MHz)	MEASURE. VALUE(uW)	LIMIT (uW)	RESULT
V_{normal}	30MHz to 1000MHz	902.878	0.000248	0.25	PASS
	1000MHz to 2387MHz	1239.604	0.029580	2.5	PASS
	2387MHz to 2400MHz	2394.938	0.022233	25	PASS
	2483.5MHz to 2496.5MHz	2483.524	1.297179	25	PASS
	2496.5MHz to 12500MHz	6407.868	0.062951	2.5	PASS
V_{max.}	30MHz to 1000MHz	811.577	0.000230	0.25	PASS
	1000MHz to 2387MHz	1239.777	0.023227	2.5	PASS
	2387MHz to 2400MHz	2387.653	0.020893	25	PASS
	2483.5MHz to 2496.5MHz	2483.607	1.383566	25	PASS
	2496.5MHz to 12500MHz	6853.024	0.066069	2.5	PASS
V_{min.}	30MHz to 1000MHz	693.480	0.000196	0.25	PASS
	1000MHz to 2387MHz	1239.777	0.025942	2.5	PASS
	2387MHz to 2400MHz	2390.076	0.024155	25	PASS
	2483.5MHz to 2496.5MHz	2483.717	1.472313	25	PASS
	2496.5MHz to 12500MHz	6956.810	0.067920	2.5	PASS

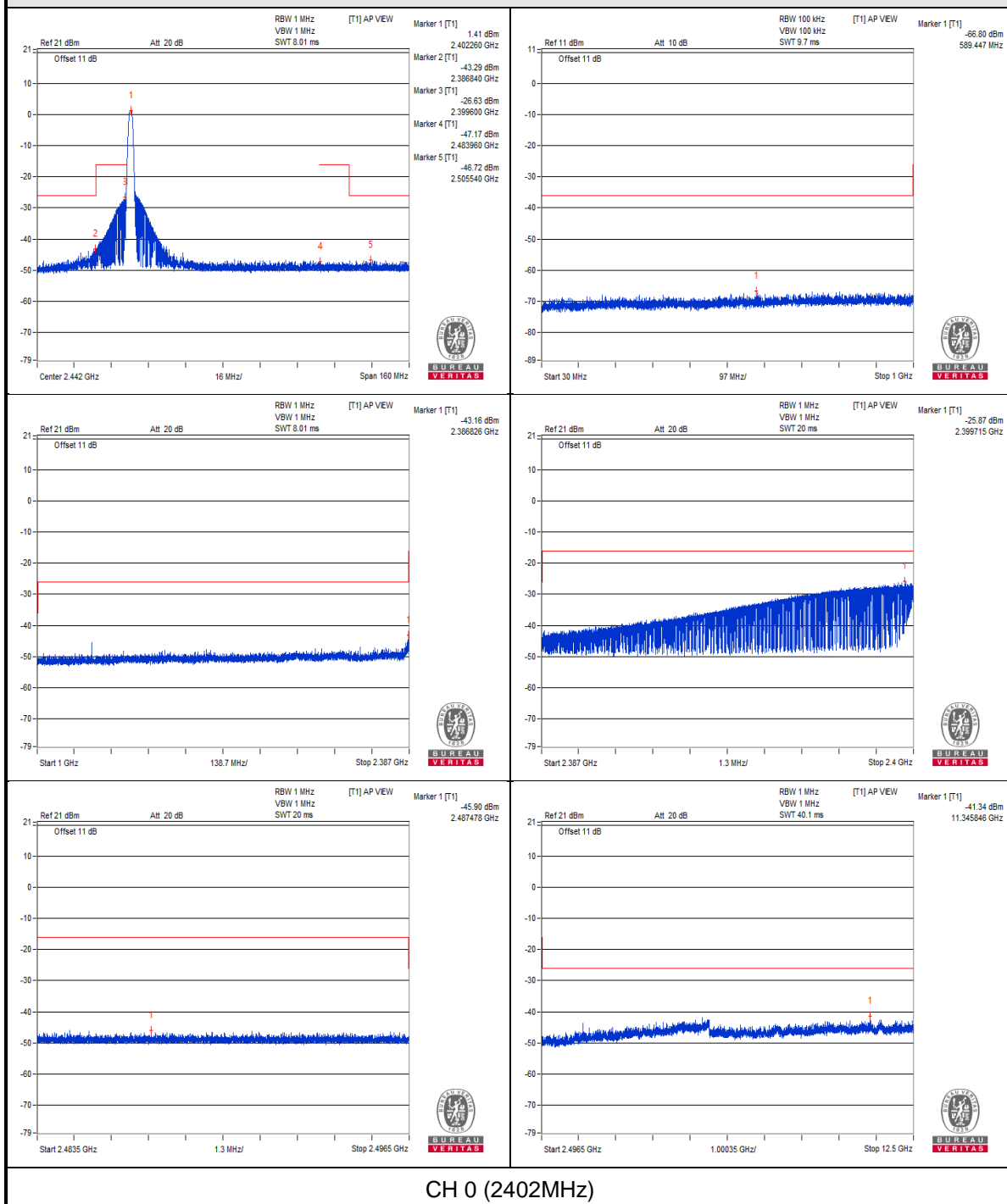
NOTE: 1. The spectrum plots are attached on the following pages.

V_{normal}

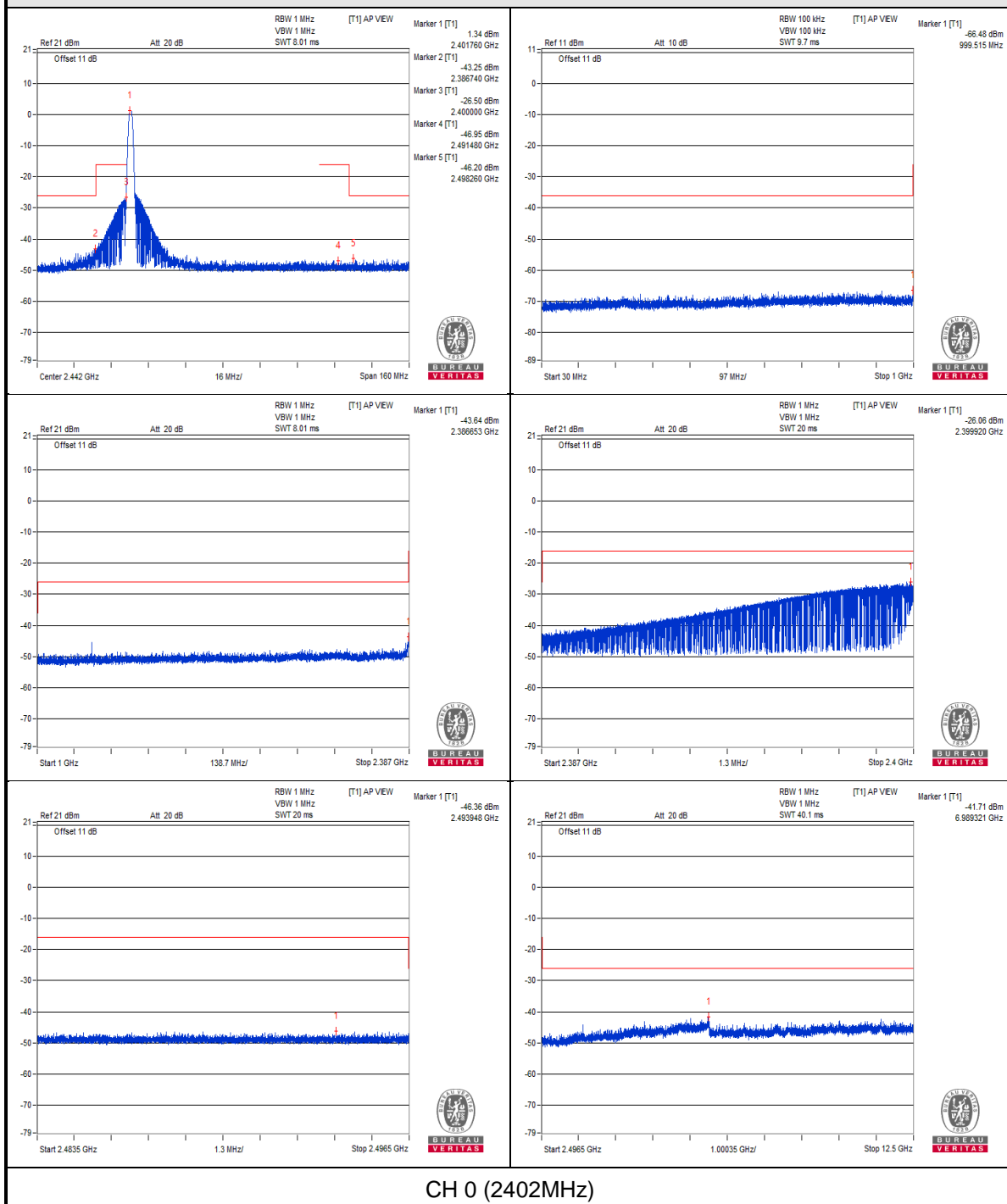


CH 0 (2402MHz)

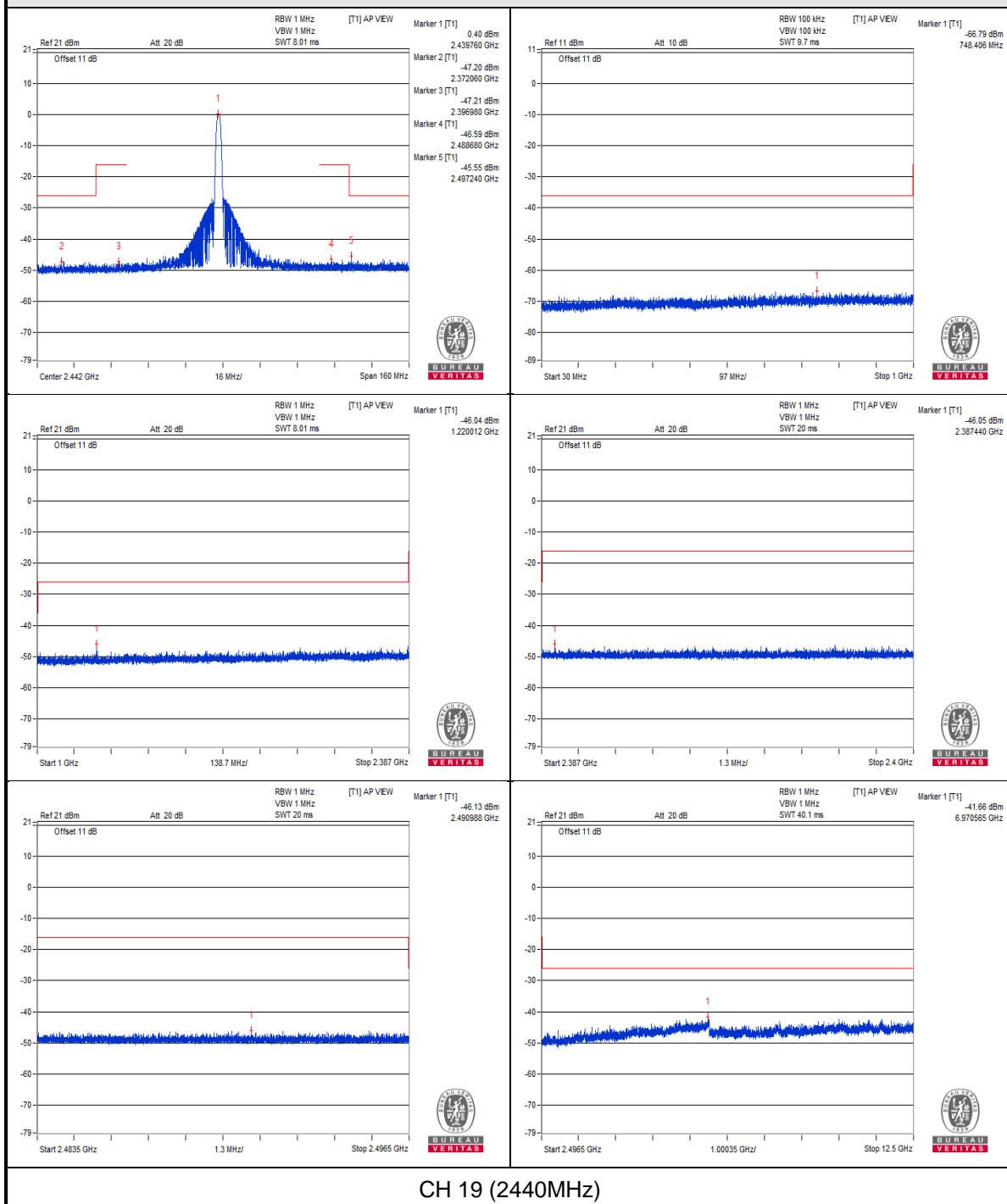
V_{max}.



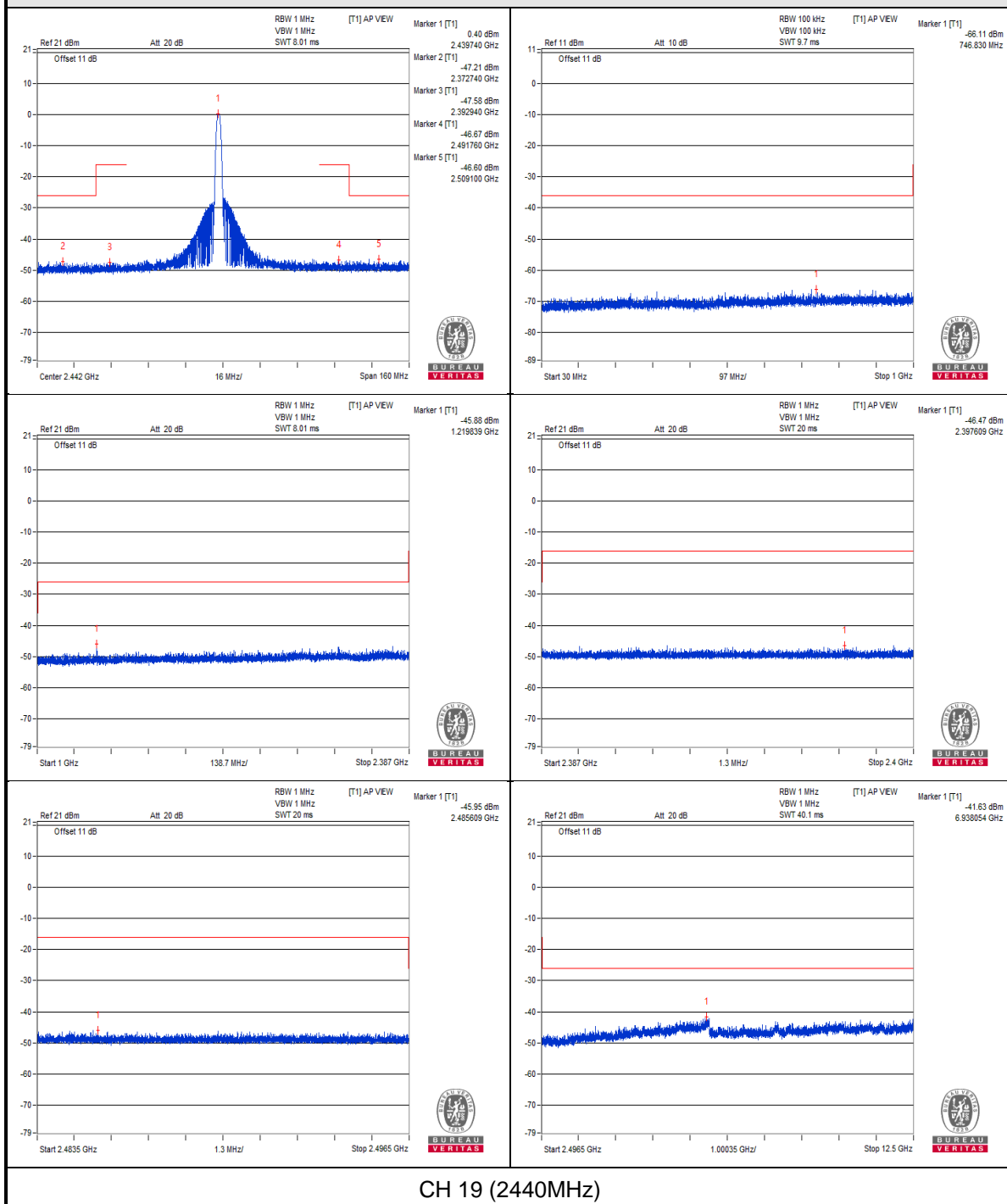
V_{min}.



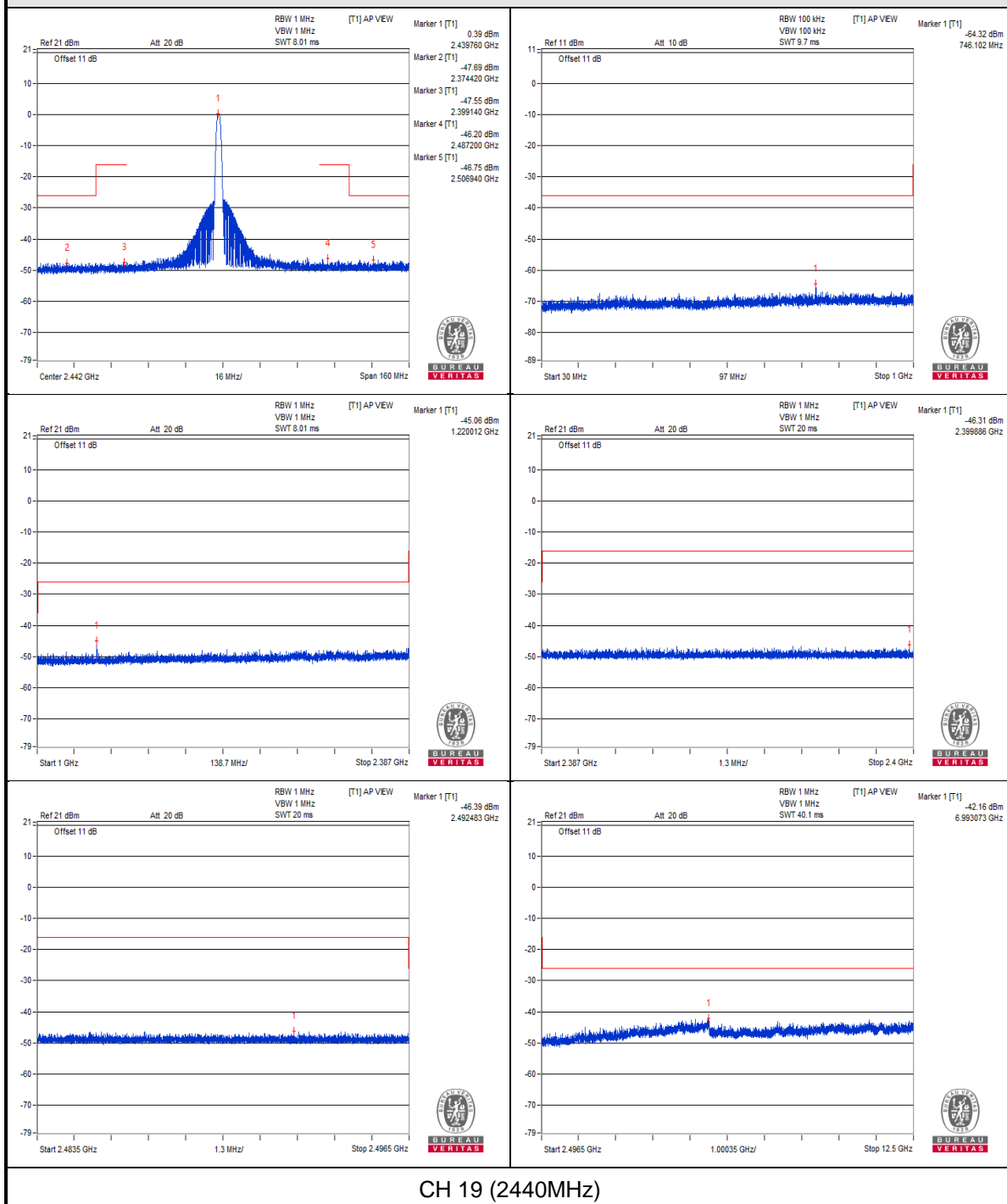
V_{normal}



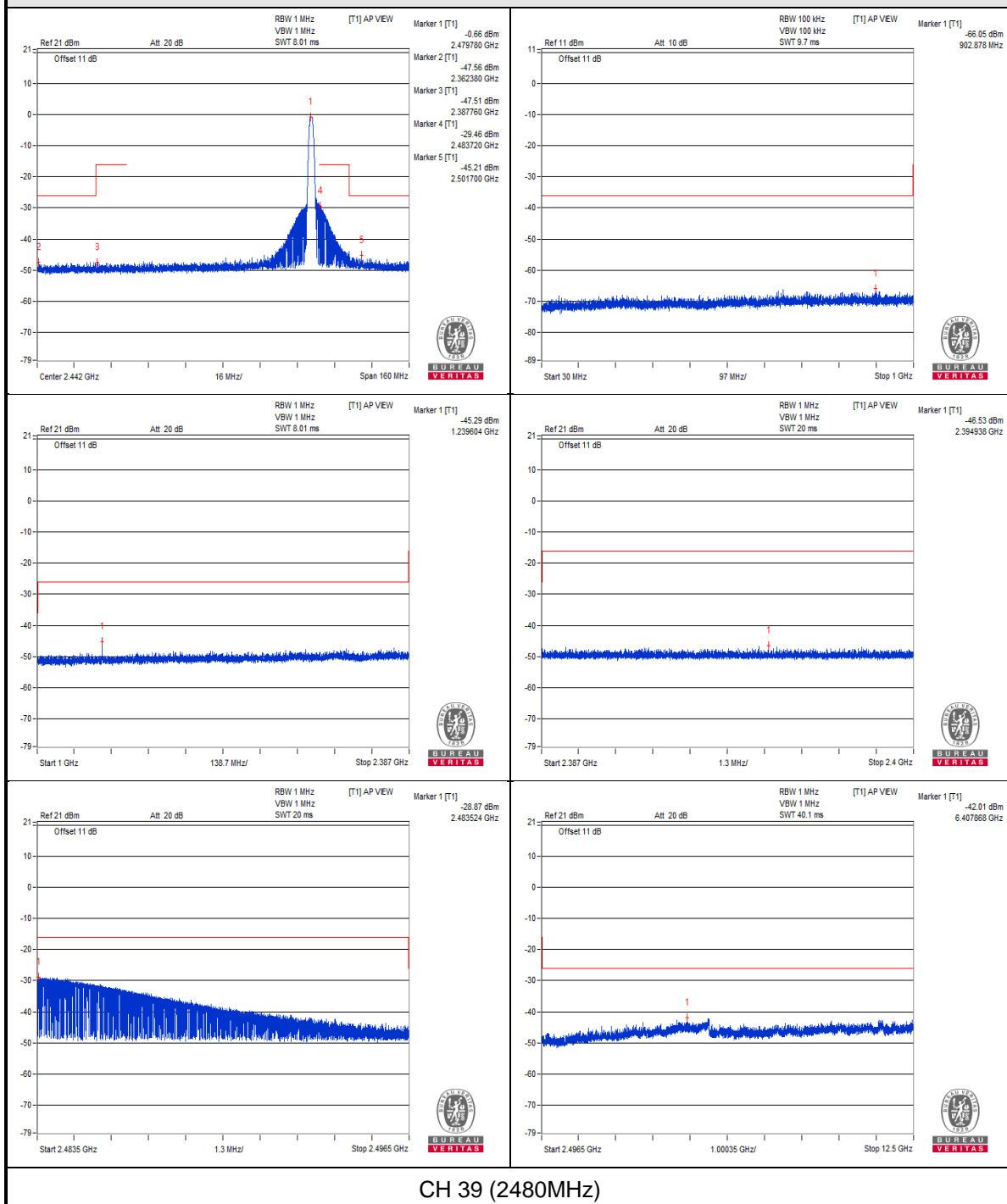
V_{max}.



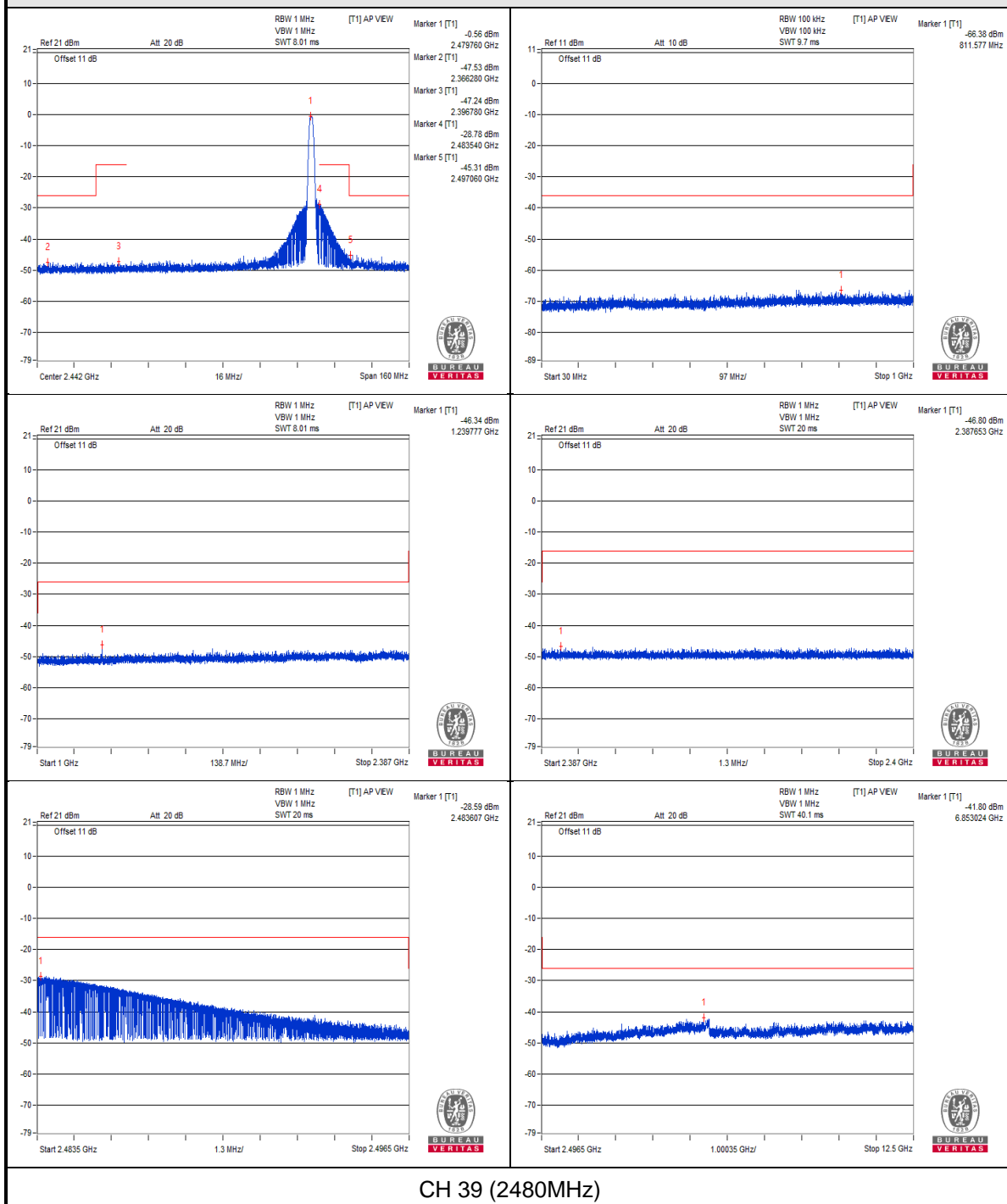
V_{min}.



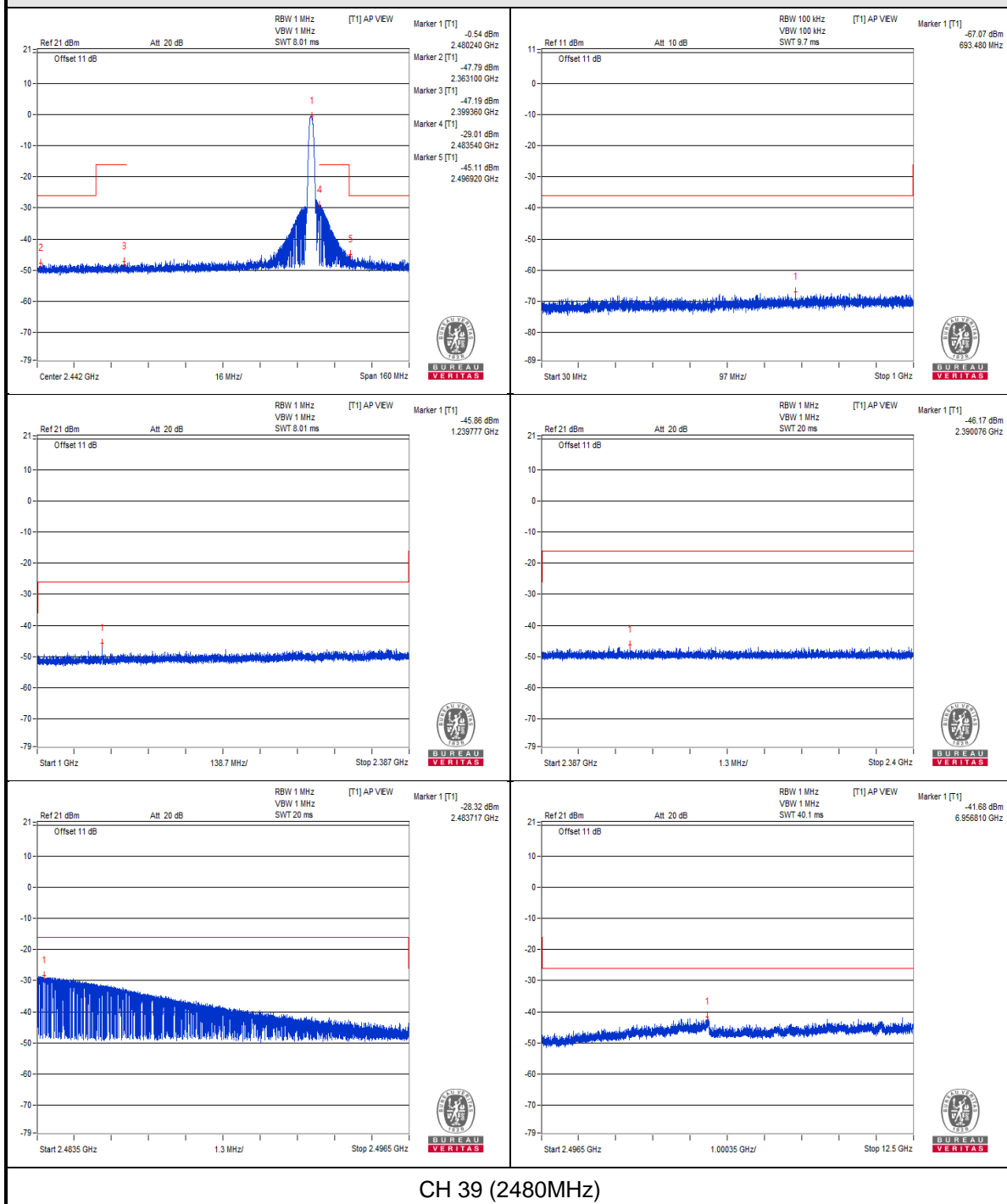
V_{normal}



V_{max}.



V_{min}.



4.4 Antenna Power Measurement

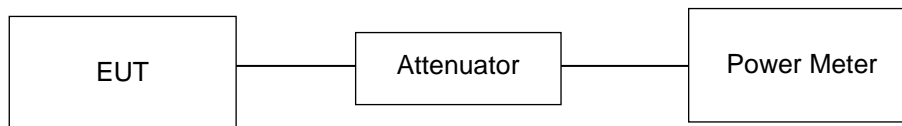
4.4.1 Limits of Antenna Power

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)
Other than the above	2400 – 2483.5 MHz	10 mW	12.14 dBm ~ 22.14 dBm (16.368 mW ~ 163.68 mW)

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).

4.4.2 Test Setup



4.4.3 Test Results

PCB antenna with antenna gain: 4.74 dBi

Voltage (Vdc)	Channel Number	Frequency (MHz)	Conducted RF Output Power (mW)	Radiated RF Output Power (mW)
3.3	0	2402	1.236	3.681
	19	2440	0.984	2.931
	39	2480	0.774	2.305
3.63	0	2402	1.219	3.631
	19	2440	0.962	2.865
	39	2480	0.74	2.204
2.97	0	2402	1.274	3.795
	19	2440	0.959	2.856
	39	2480	0.748	2.228
Max. Limit (mW):			10	-
Rated Power (mW):			2	-
Tolerance of Antenna Power (mW):			0.4 ~ 2.4	-
Max. EIRP Limit (mW):			-	16.368

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

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

4.5 Spurious Emissions for Receiver

4.5.1 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)

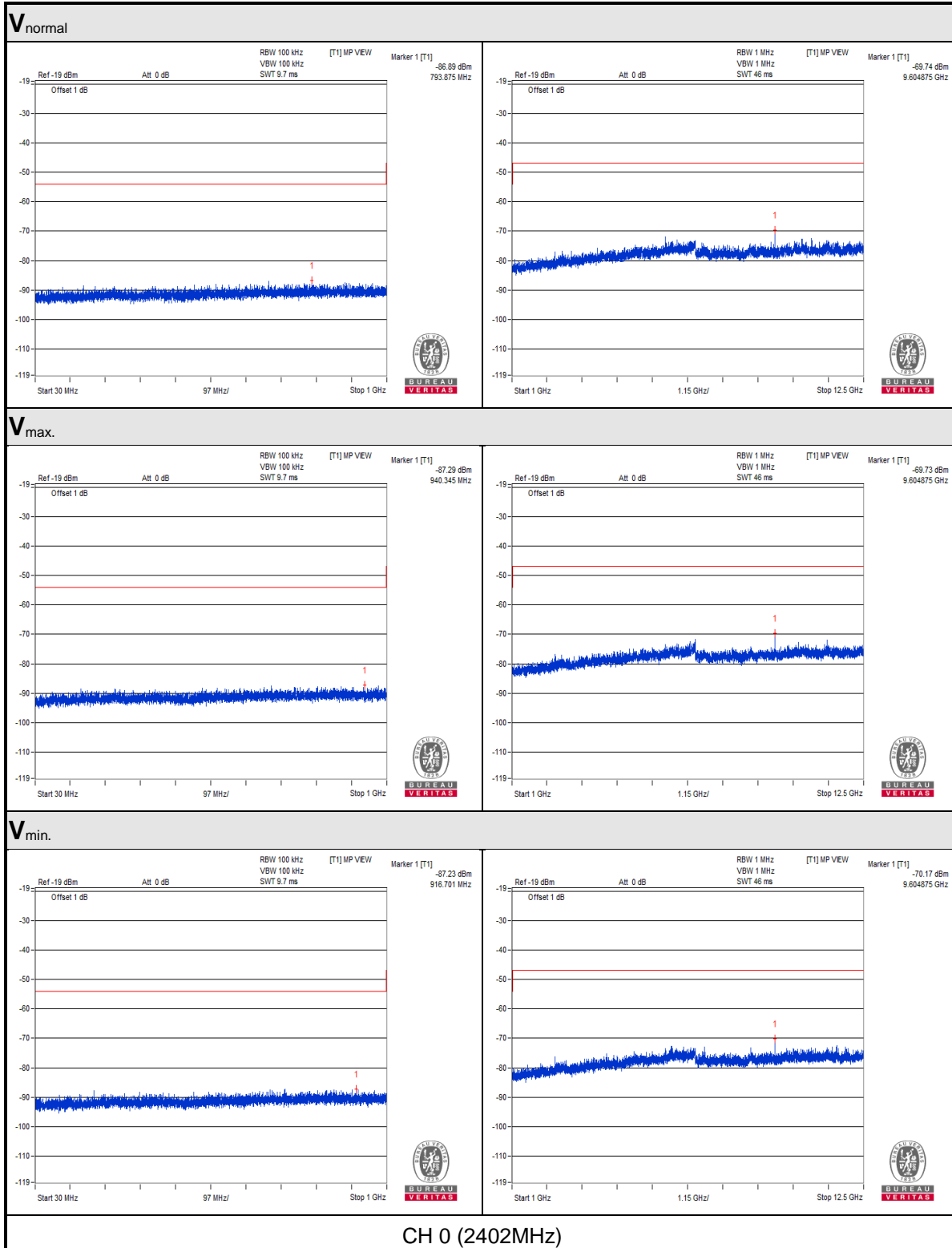
4.5.2 Test Setup



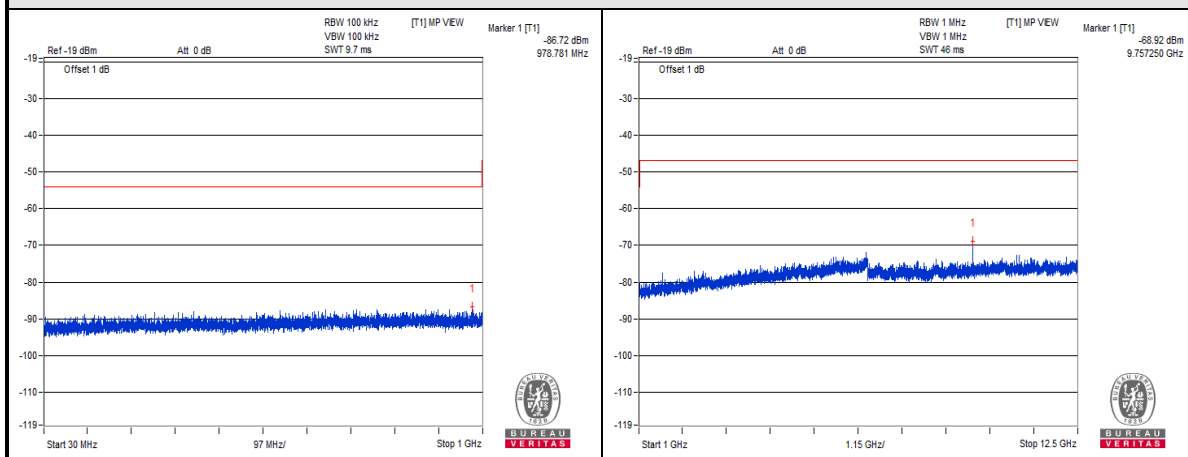
4.5.3 Test Result

TEST CHANNEL		CH 0 (2402MHz)			
TEST CONDITION	FREQUENCY RANGE(MHz)	FREQUENCY (MHz)	MEASURE. VALUE(nW)	LIMIT (nW)	RESULT
V_{normal}	30MHz to 1000MHz	793.875	0.002046	4.0	PASS
	1000MHz to 12500MHz	9604.875	0.106170	20.0	PASS
V_{max.}	30MHz to 1000MHz	940.345	0.001866	4.0	PASS
	1000MHz to 12500MHz	9604.875	0.106414	20.0	PASS
V_{min.}	30MHz to 1000MHz	916.701	0.001892	4.0	PASS
	1000MHz to 12500MHz	9604.875	0.096161	20.0	PASS
TEST CHANNEL		CH 19 (2440MHz)			
V_{normal}	30MHz to 1000MHz	978.781	0.002128	4.0	PASS
	1000MHz to 12500MHz	9757.250	0.128233	20.0	PASS
V_{max.}	30MHz to 1000MHz	242.551	0.001901	4.0	PASS
	1000MHz to 12500MHz	9757.250	0.098628	20.0	PASS
V_{min.}	30MHz to 1000MHz	673.958	0.001726	4.0	PASS
	1000MHz to 12500MHz	9757.250	0.113763	20.0	PASS
TEST CHANNEL		CH 39 (2480MHz)			
V_{normal}	30MHz to 1000MHz	953.925	0.002312	4.0	PASS
	1000MHz to 12500MHz	9916.812	0.109144	20.0	PASS
V_{max.}	30MHz to 1000MHz	626.065	0.001986	4.0	PASS
	1000MHz to 12500MHz	9916.812	0.089536	20.0	PASS
V_{min.}	30MHz to 1000MHz	992.361	0.001718	4.0	PASS
	1000MHz to 12500MHz	9916.812	0.104472	20.0	PASS

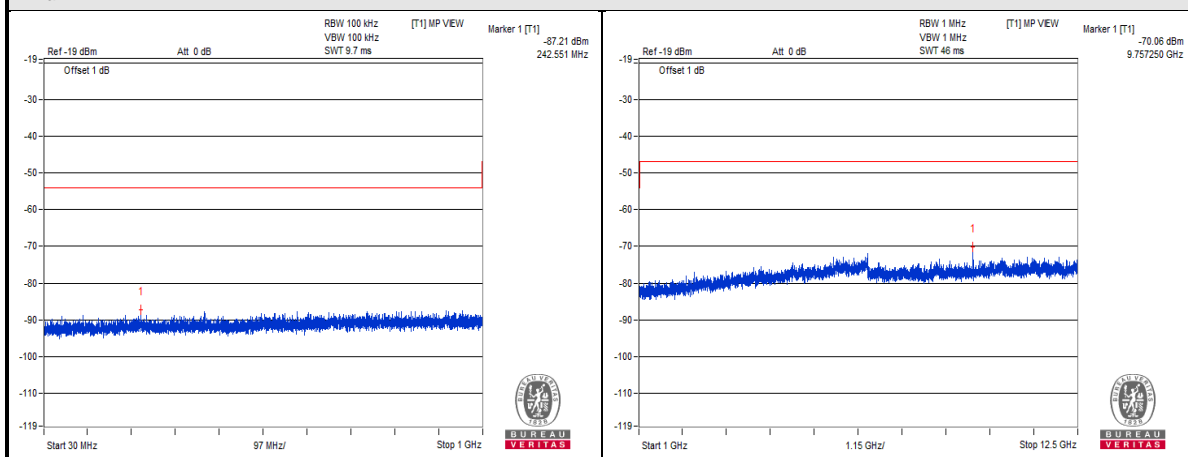
Note: 1. The spectrum plots are attached on the following pages.



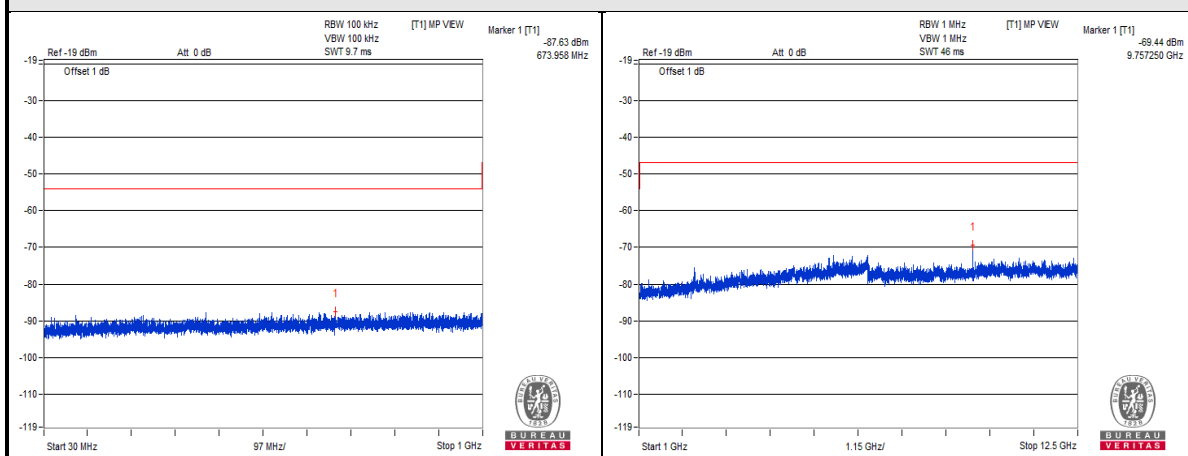
V_{normal}



V_{max}

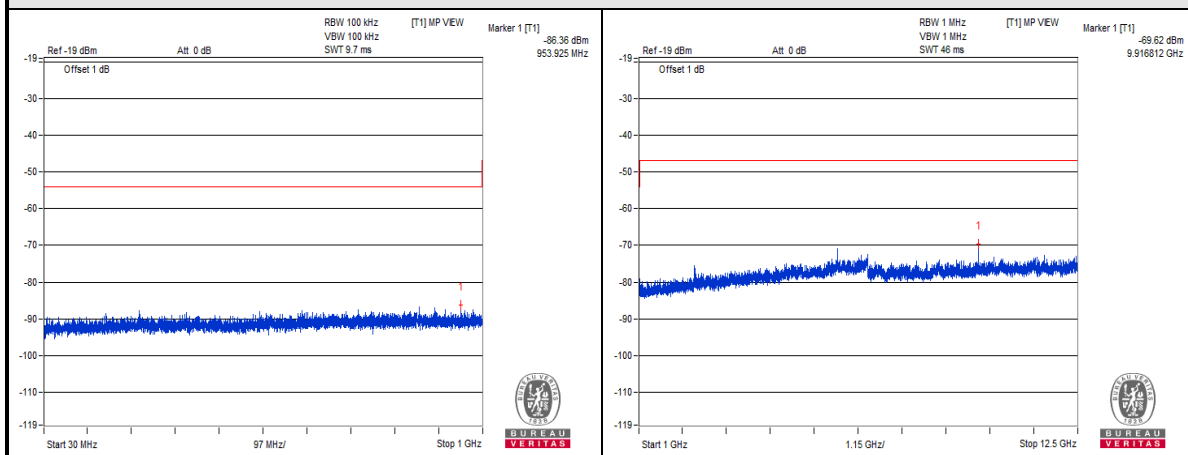


V_{min}

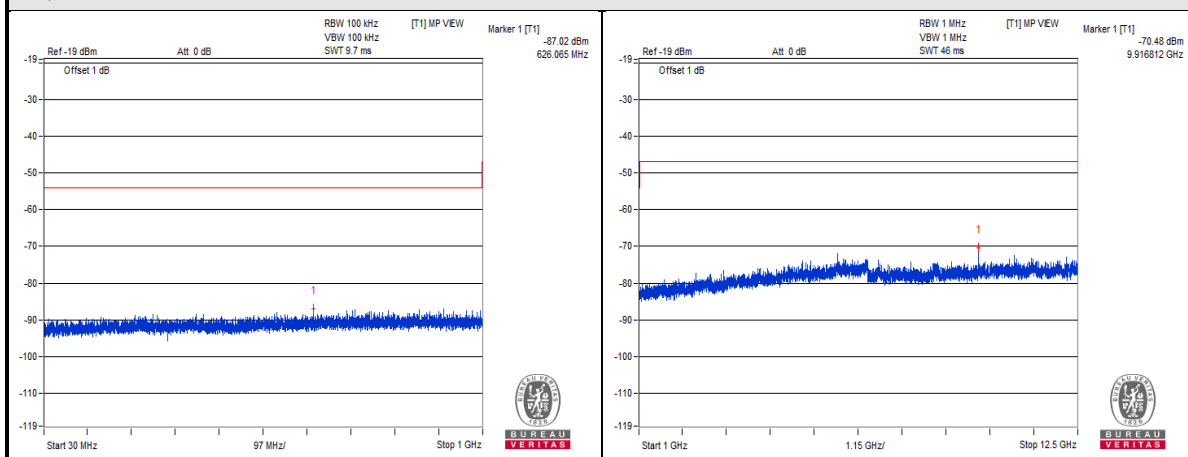


CH 19 (2440MHz)

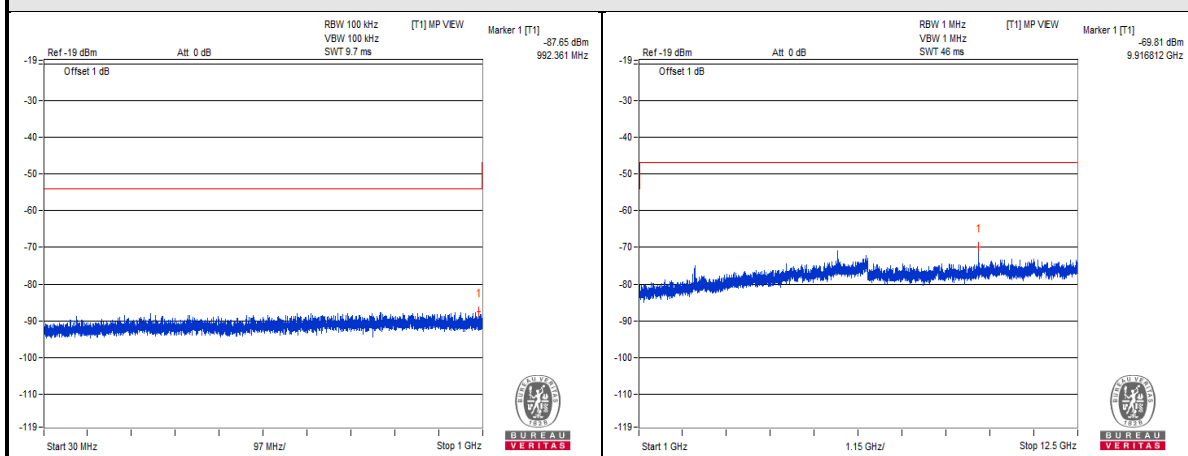
V_{normal}



V_{max}



V_{min}



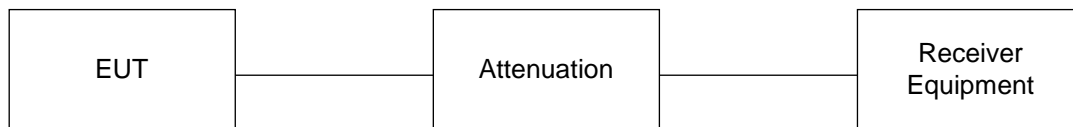
CH 39 (2480MHz)

4.6 Interference Prevention Function

4.6.1 Limits of Interference Prevention Function

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

4.6.2 Test Setup



4.6.3 Test Results

Environmental Conditions	25 deg.C, 60% RH
Link Mode	Test Result
BT-LE	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

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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