

## TEST REPORT



Applicant	Zound Industries International AB
Address	Centralplan 15 SE-111 20 Stockholm Sweden

Manufacturer or Supplier	Zound Industries International AB	
Address	Centralplan 15 SE-111 20 Stockholm Sweden	
Product	True Wireless Headphones	
Brand Name	Marshall	
Model	MINOR III	
Additional Models & Model Difference	N/A	
Date of tests	Feb. 22, 2021 ~ Mar. 22, 2021	

the tests have been carried out according to the requirements of the following standards:

☒ ARIB STD-T66, Article 2 Section 1 Item 19

**CONCLUSION: The submitted sample was found to COMPLY with the test requirement**

Tested by Lucas Chen Project engineer/ EMC Department	Approved by Glyn He Assistant Manager / EMC Department
	  Date: May 11, 2021

This report is governed by, and incorporates by reference, CPS Conditions of Service as posted at the date of issuance of this report at <https://www.cps.bureauveritas.com/terms-conditions> and is intended 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. Measurement uncertainty is only provided upon request for accredited tests. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence or if you require measurement uncertainty; 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.

## TABLE OF CONTENTS

<b>RELEASE CONTROL RECORD .....</b>	<b>4</b>
<b>1 SUMMARY OF TEST RESULTS .....</b>	<b>5</b>
1.1 MEASUREMENT UNCERTAINTY .....	6
<b>2 GENERAL INFORMATION.....</b>	<b>7</b>
2.1 GENERAL DESCRIPTION OF EUT .....	7
2.2 DESCRIPTION OF TEST CHANNELS.....	8
2.3 TEST CONDITIONS .....	9
2.4 ASSEMBLY .....	9
2.5 ANTENNA SPECIFICATIONS .....	9
2.5.1 ANTENNA GAIN .....	9
2.5.2 ANTENNA PATTERN.....	9
<b>3 TEST RESULTS.....</b>	<b>10</b>
3.1 FREQUENCY TOLERANCE MEASUREMENT .....	10
3.1.1 LIMITS OF FREQUENCY TOLERANCE MEASUREMENT .....	10
3.1.2 TEST SETUP.....	10
3.1.3 TEST RESULTS .....	11
3.2 OCCUPIED BANDWIDTH MEASUREMENT (99% POWER BANDWIDTH).....	12
3.2.1 LIMITS OF OCCUPIED BANDWIDTH MEASUREMENT .....	12
3.2.2 TEST SETUP.....	12
3.2.3 TEST RESULTS .....	12
3.3 SPREADING BANDWIDTH MEASUREMENT (90% POWER BANDWIDTH).....	16
3.3.1 LIMITS OF SPREADING BANDWIDTH AND SPREADING FACTOR.....	16
3.3.2 TEST SETUP.....	16
3.3.3 TEST RESULTS .....	16
3.4 SPURIOUS EMISSIONS FOR TRANSMITTER MEASUREMENT.....	20
3.4.1 LIMITS OF SPURIOUS EMISSIONS .....	20
3.4.2 TEST SETUP.....	20
3.4.3 SUMMARY OF TEST RESULT .....	21
3.5 ANTENNA POWER MEASUREMENT .....	32
3.5.1 LIMITS OF ANTENNA POWER.....	32
3.5.2 TEST SETUP.....	32
3.5.3 TEST RESULTS .....	33
3.6 SPURIOUS EMISSIONS FOR RECEIVER.....	34
3.6.1 LIMITS OF SPURIOUS EMISSIONS FOR RECEIVER .....	34
3.6.2 TEST SETUP.....	34
3.6.3 SUMMARY OF TEST RESULT .....	35
3.7 CARRIER SENSE CAPABILITY .....	39
3.7.1 MEASURING SYSTEM BLOCK DIAGRAM .....	39
3.7.2 MEASURING OPERATION PROCEDURES .....	39
3.7.3 LEVEL OF THE AMBIENT CARRIER.....	40
3.8 INTERFERENCE PREVENTION FUNCTION.....	41
3.8.1 LIMITS OF INTERFERENCE PREVENTION FUNCTION.....	41
3.8.2 TEST SETUP.....	41
3.8.3 TEST RESULTS .....	41
<b>4 TEST INSTRUMENTS.....</b>	<b>42</b>



Test Report No.: RJ2102WDG0118-1

5	PHOTOGRAPHS OF THE TEST CONFIGURATION .....	43
6	APPENDIX A – MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB .....	44



## **RELEASE CONTROL RECORD**

<b>ISSUE NO.</b>	<b>REASON FOR CHANGE</b>	<b>DATE ISSUED</b>
RJ2102WDG0118-1	Original release	May 11, 2021



# 1 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications (For BT-LE):

Article 2 Section 1 Item 19 Reference	ARIB STD-T66 Ref.	Report reference	Parameter	Test Results (NOTE)
<b>GENERAL PROVISIONS</b>				
C	3.2 (4)	3.1	Frequency tolerance	C
D	3.2 (7)	3.2	Occupied bandwidth	C
E	3.2 (6)	3.4	Spurious emissions	C
<b>TRANSMITTING EQUIPMENT</b>				
F	3.2(1)	3.5	Antenna power	C
--	--	--	SAR	NA
<b>TRANSMITTING ANTENNA</b>				
--	--	2.5	Type, configuration, etc. of transmitting antenna	C
--	--	2.5	Direction pattern of transmitting antenna	C
<b>RECEIVING EQUIPMENT</b>				
G	3.3 (1)	3.6	Spurious emissions of receiver	C
--	--	2.5	Refer to all articles for transmitting antenna	C
<b>OPERATING FREQUENCY 2400 TO 2483.5MHz</b>				
--	3.7 (1)	2.4	High Frequency/modulation section cannot be opened easily	C
--	3.1 (1)	2.1	Communication method	C
--	3.2 (1)a	2.1	Modulation method	C
--	3.2 (1)a	3.3	Spread spectrum method	C
--	3.2 (2)	3.5	Antenna power	C
--	3.6 (2)	3.5	Absolute gain of transmitting antenna	C
--	3.6 (2)	3.5	Angular width of principal radiation (AWPR)	C
--	3.2 (10)	--	Number of carriers within 1 MHz bandwidth in OFDM	NA
--	3.2 (8)	3.3	Diffusion bandwidth	C
--	3.2 (9)	3.3	Spreading factor	C
--	3.4.1(1)	3.8	Interference Prevention Function	C
--	3.4.1(3)	3.7	Carrier Sense Capability	C
<b>NOTE:</b> C = Conform NC = Not Conform NT = Not Tested NA = Not Applicable				



## 1.1 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT:

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

ITEM	UNCERTAINTY
Occupied Bandwidth	206.50 Hz
Spurious emissions	$\pm 3.93\text{dB}$
Output power density	1.37dB
Out of band radiated power	2.52 dB
Frequency Tolerance	0.104 ppm



## 2 GENERAL INFORMATION

### 2.1 GENERAL DESCRIPTION OF EUT

<b>PRODUCT</b>	True Wireless Headphones
<b>MODEL NO.</b>	MINOR III
<b>POWER SUPPLY:</b>	Earbuds: DC 3.7V from Li-ion Battery or DC 5V from Charging Case; Charging Case: DC 3.7V from Li-ion Battery or DC 5V from USB Host Unit or Powered by Wireless Charger
<b>ADDITIONAL MODEL</b>	N/A
<b>TYPE OF EQUIPMENT</b>	Data transmission equipment operating in the 2.4GHz
<b>MODULATION TYPE</b>	BT-LE GFSK(1 Mbps)
<b>MODULATION TECHNOLOGY</b>	DTS
<b>OPERATING FREQUENCY</b>	2402MHz ~ 2480MHz
<b>NUMBER OF CHANNEL</b>	40
<b>RATED RF OUTPUT POWER</b>	3 mW
<b>CONDUCTED RF OUTPUT POWER</b>	2.466mW
<b>EIRP OUTPUT POWER</b>	2.143mW
<b>HW-RELEASE NO</b>	APETW2002
<b>SW-RELEASE NO</b>	V3.0.2
<b>ANTENNA TYPE</b>	FPC Antenna, -0.61dBi Gain
<b>CABLE SUPPLIED</b>	USB Line: Unshielded, Detachable 18cm

#### NOTES:

1. For the test results, the EUT had been tested with all conditions.
2. The above EUT information was declared by manufacturer and for more detailed features description please refers to the manufacturer's specifications or user's manual.
3. This product has two Bluetooth chips (distribute left ear and right ear), they are identical in RF circuitry and antenna, but only the worst case was (left ear) shown in test report.



## 2.2 DESCRIPTION OF TEST CHANNELS

40 channels are provided for BT-LE (GFSK):

CHANNEL	FREQ. (MHZ)	CHANNEL	FREQ. (MHZ)	CHANNEL	FREQ. (MHZ)	CHANNEL	FREQ. (MHZ)
<b>0</b>	<b>2402</b>	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	<b>19</b>	<b>2440</b>	29	2460	<b>39</b>	<b>2480</b>

### 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.
2. By means of test software for BT LE provided by manufacturer, the power levels during the tests were set according to the following codes:

BT-LE (GFSK)	
CHANNEL	POWER SETTING
<b>0</b>	Default
<b>19</b>	Default
<b>39</b>	Default





## 2.3 TEST CONDITIONS

Test conditions	Voltage (Vdc)
$V_{\text{normal}}$	3.70
$V_{\text{max}}$	4.07
$V_{\text{min}}$	3.33

## 2.4 ASSEMBLY

The RF circuits are located inside of the EUT. The RF circuit is enclosed in a plastic case. Frequency Band, channels and modulation parameters are fixed inside the module. They cannot be edited or modified by end-user.

## 2.5 ANTENNA SPECIFICATIONS

### 2.5.1 ANTENNA GAIN

Ant. Type	Connector Type	Highest Peak Gain (dBi) 2.4GHz ~ 2.5GHz
FPC	N/A	-0.61

### 2.5.2 ANTENNA PATTERN

Please refer to the attached file (Antenna report).



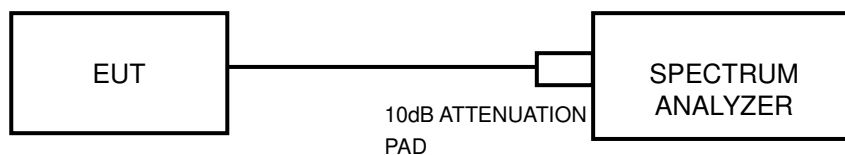
### 3 TEST RESULTS

#### 3.1 FREQUENCY TOLERANCE MEASUREMENT

##### 3.1.1 LIMITS OF FREQUENCY TOLERANCE MEASUREMENT

Tolerance of frequency shall be +/- 50ppm

##### 3.1.2 TEST SETUP





### 3.1.3 TEST RESULTS

#### BT-LE GFSK

ENVIRONMENTAL CONDITIONS		23 deg.C, 54% RH					
Channel	Frequency (MHz)	Voltage normal		Voltage +10%		Voltage -10%	
		Carrier frequency (MHz)	Frequency tolerance (ppm)	Carrier frequency (MHz)	Frequency tolerance (ppm)	Carrier frequency (MHz)	Frequency tolerance (ppm)
0	2402	2401.994520	-2.281	2401.994279	-2.381	2401.994120	-2.447
19	2440	2439.993560	-2.639	2439.993440	-2.688	2439.993320	-2.737
39	2480	2479.992800	-2.903	2479.992640	-2.967	2479.992559	-3.000

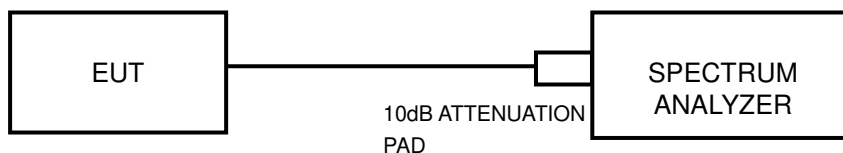


### 3.2 OCCUPIED BANDWIDTH MEASUREMENT (99% POWER BANDWIDTH)

#### 3.2.1 LIMITS OF OCCUPIED BANDWIDTH MEASUREMENT

ITEM	LIMIT	REMARK
Occupied bandwidth	<26MHz	For 802.11b, g & 802.11n (HT20)
Occupied bandwidth	<26MHz	For BT-LE (GFSK)

#### 3.2.2 TEST SETUP



#### 3.2.3 TEST RESULTS

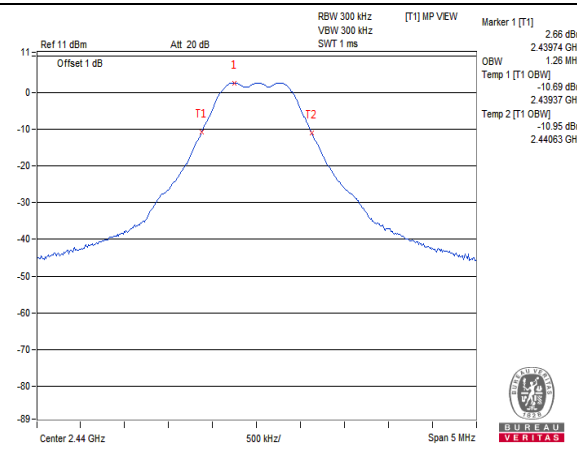
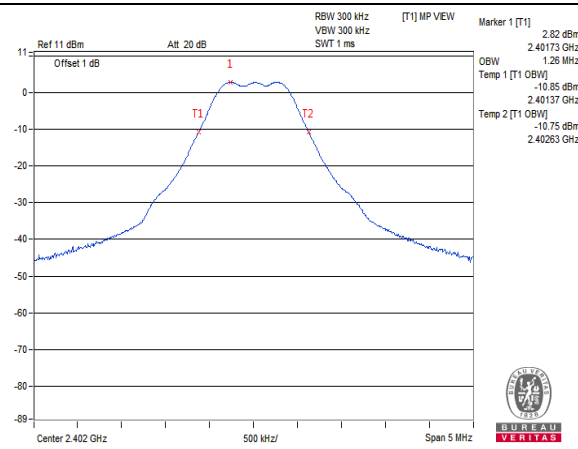
##### BT-LE GFSK (1Mbps)

ENVIRONMENTAL CONDITIONS		23 deg.C, 54% RH		
CHANNEL	FREQUENCY (MHz)	V <sub>normal</sub>	V <sub>+10%</sub>	V <sub>-10%</sub>
		OCCUPIED BANDWIDTH (MHz)	OCCUPIED BANDWIDTH (MHz)	OCCUPIED BANDWIDTH (MHz)
0	2402	1.26	1.26	1.26
19	2440	1.26	1.26	1.26
39	2480	1.26	1.26	1.26
Measurement uncertainty		± 206.50 Hz		

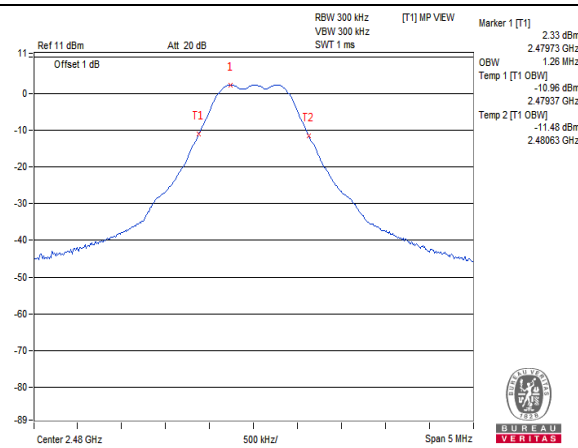
**NOTE:** For the test plots please refer to the below pages.



**Vnormal**



**Channel 0**



**Channel 19**

**Channel 39**

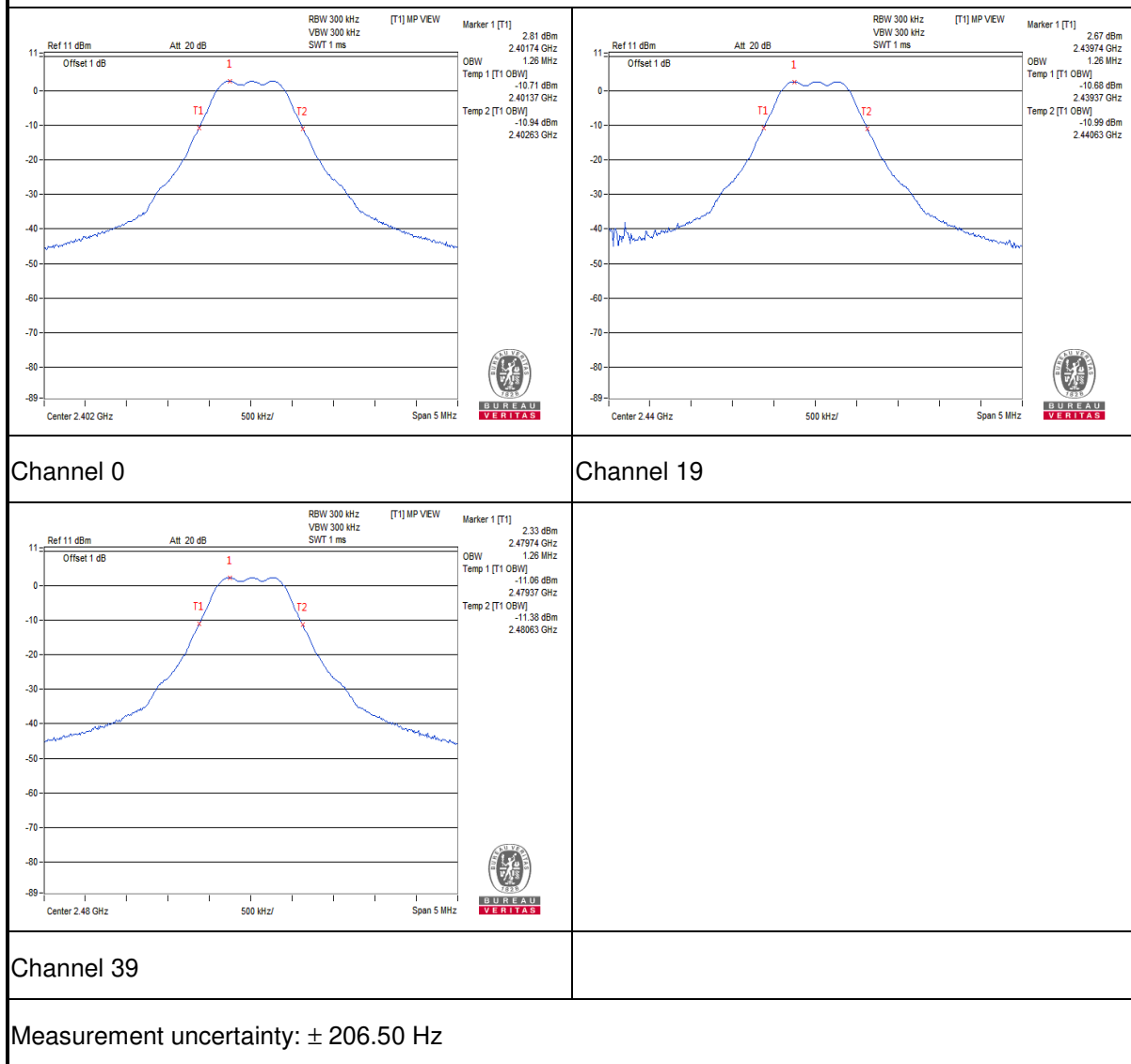
Measurement uncertainty:  $\pm 206.50$  Hz



BUREAU  
VERITAS

Test Report No.: RJ2102WDG0118-1

V<sub>+10%</sub>

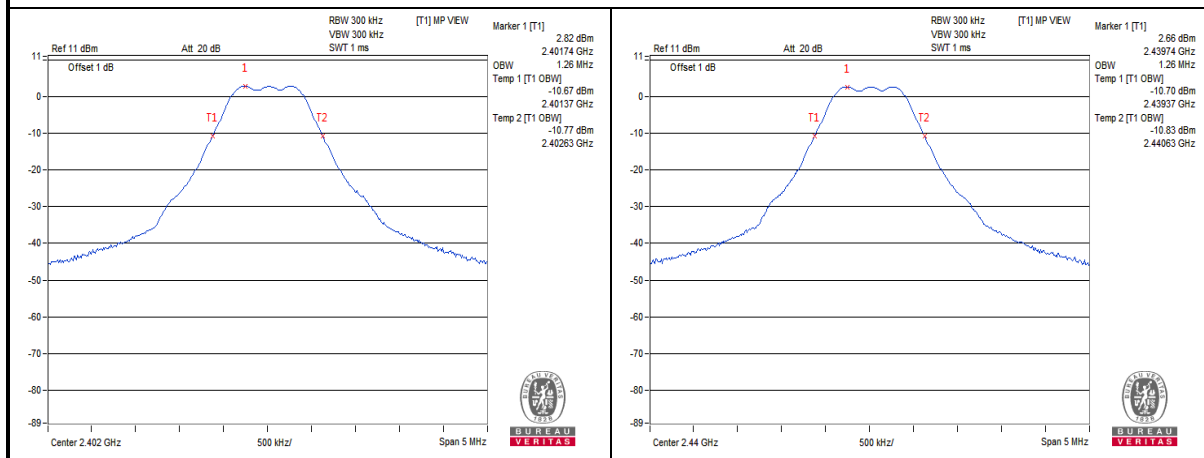




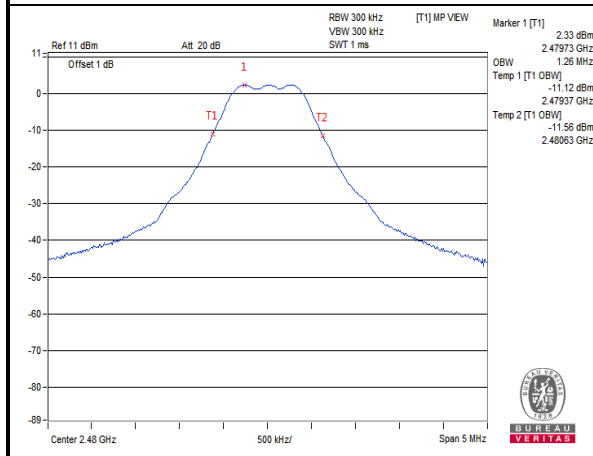
**BUREAU  
VERITAS**

**Test Report No.: RJ2102WDG0118-1**

**V-10%**



**Channel 0**



**Channel 19**

**Channel 39**

**Measurement uncertainty:  $\pm 206.50$  Hz**

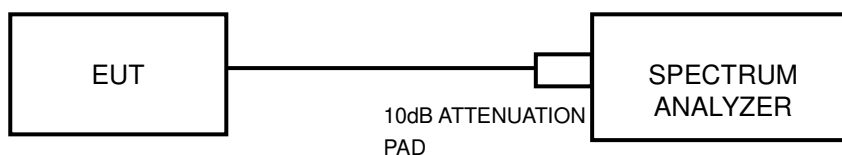


### 3.3 SPREADING BANDWIDTH MEASUREMENT (90% POWER BANDWIDTH)

#### 3.3.1 LIMITS OF SPREADING BANDWIDTH AND SPREADING FACTOR

ITEM	LIMIT	REMARK
SPREADING BANDWIDTH	$\geq 500\text{kHz}$	(For DSSS, FHSS)
SPREADING FACTOR	$\geq 5$	Operating frequency 2400 to 2483MHz

#### 3.3.2 TEST SETUP



#### 3.3.3 TEST RESULTS

##### BT-LE GFSK

ENVIRONMENTAL CONDITIONS		23 deg.C, 54% RH					
CHANNEL	FREQUENCY (MHz)	$V_{\text{normal}}$		$V_{+10\%}$		$V_{-10\%}$	
		SPREADING BANDWIDTH (MHz)	SPREADING FACTOR	SPREADING BANDWIDTH (MHz)	SPREADING FACTOR	SPREADING BANDWIDTH (MHz)	SPREADING FACTOR
0	2402	0.86	13.76	0.86	13.76	0.86	13.76
19	2440	0.86	13.76	0.86	13.76	0.86	13.76
39	2480	0.86	13.76	0.86	13.76	0.86	13.76
Measurement uncertainty		$\pm 206.50 \text{ Hz}$					

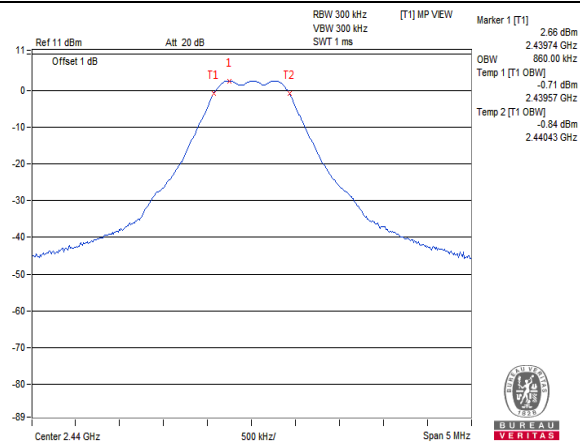
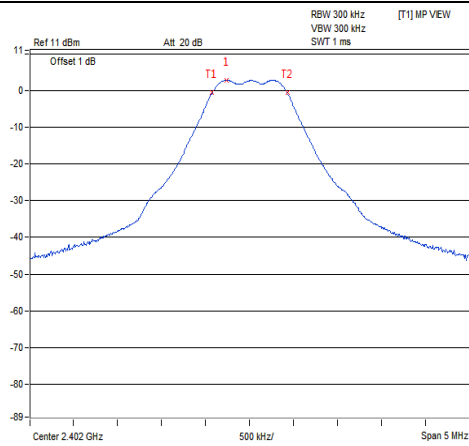
**NOTE:** For the test plots please refer to the below pages.

Spreading Factor: 90% channel power bandwidth / 0.0625

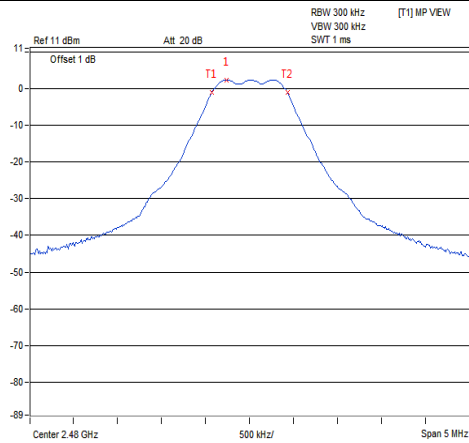




## Vnormal



## Channel 0



## Channel 19

## Channel 39

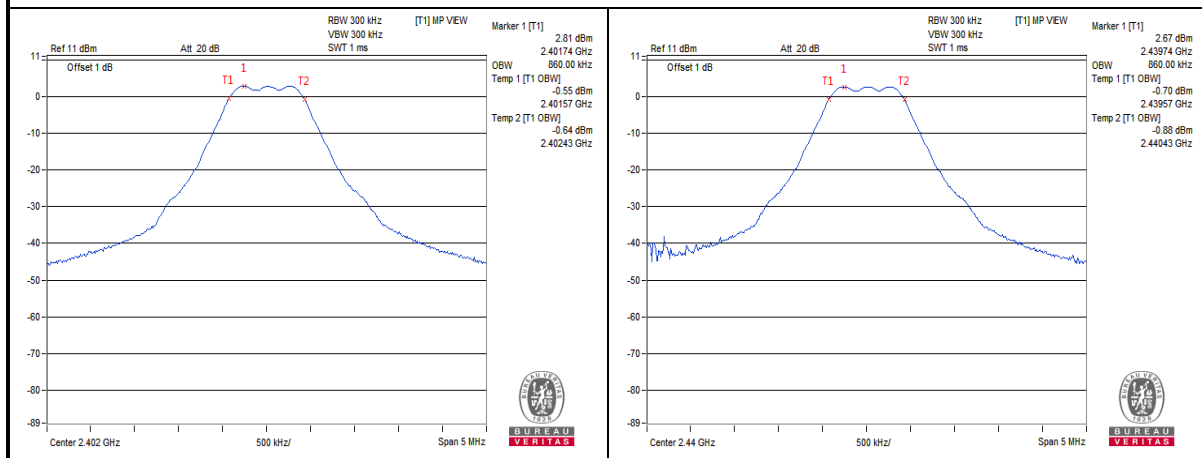
Measurement uncertainty:  $\pm 206.50$  Hz



**BUREAU  
VERITAS**

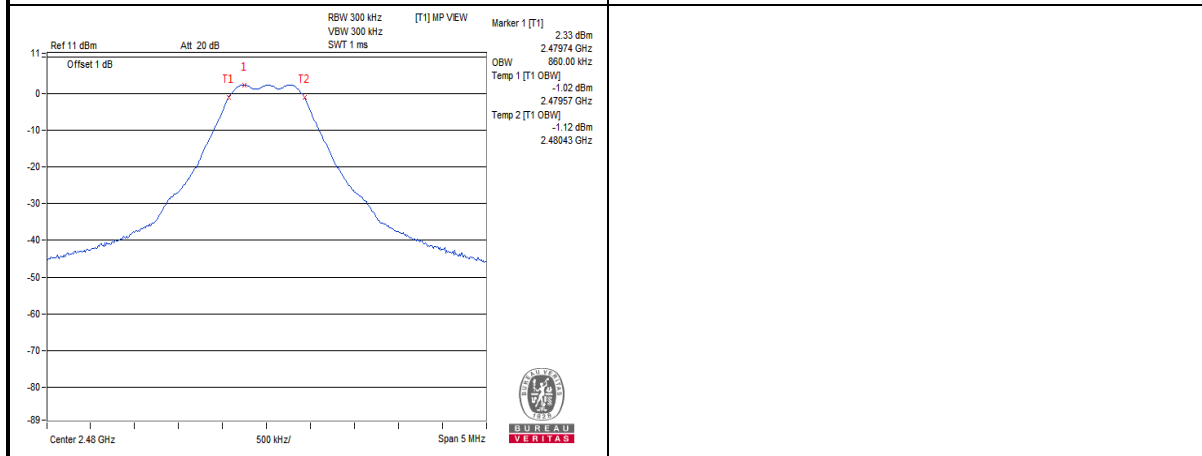
Test Report No.: RJ2102WDG0118-1

V<sub>+10%</sub>



Channel 0

Channel 19



Channel 39

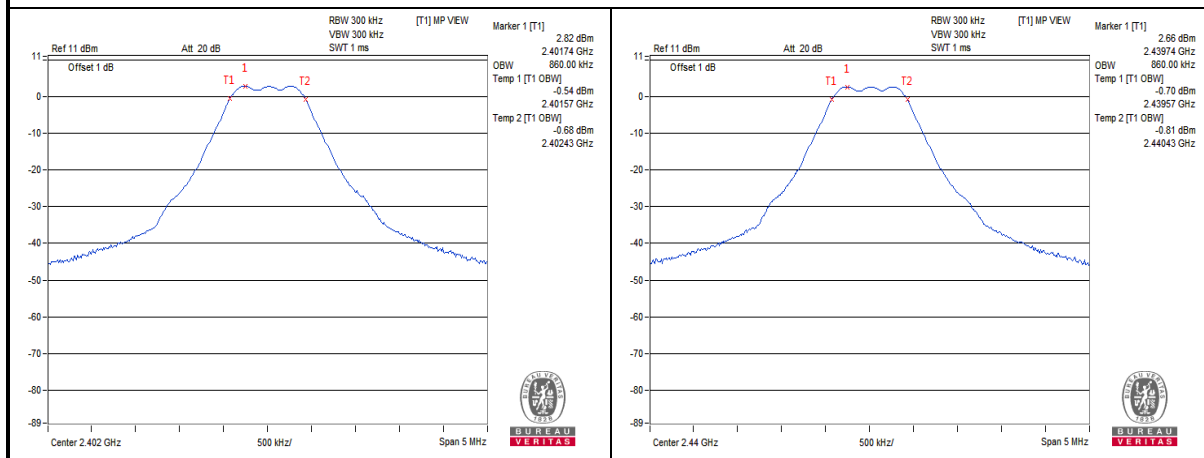
Measurement uncertainty:  $\pm 206.50$  Hz



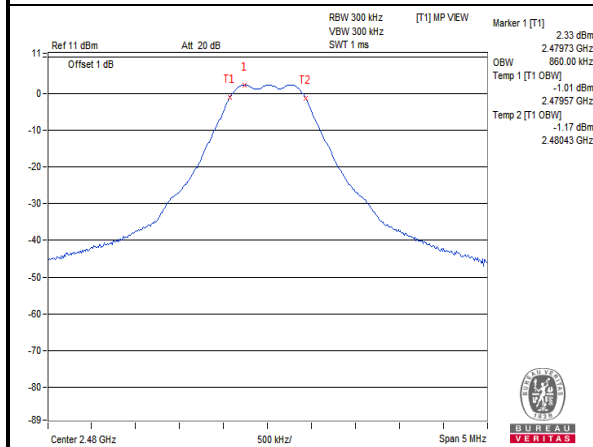
BUREAU  
VERITAS

Test Report No.: RJ2102WDG0118-1

V-10%



Channel 0



Channel 19

Channel 39

Measurement uncertainty:  $\pm 206.50$  Hz

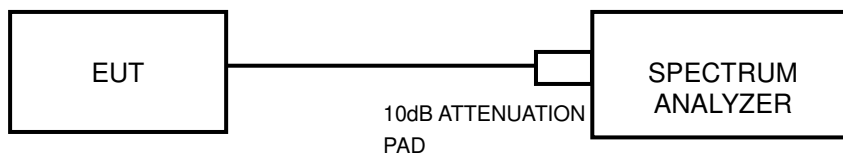


### 3.4 SPURIOUS EMISSIONS FOR TRANSMITTER MEASUREMENT

#### 3.4.1 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	$\leq 2.5\mu\text{W}/\text{MHz}$

#### 3.4.2 TEST SETUP





## 3.4.3 SUMMARY OF TEST RESULT

## BT-LE GFSK

ENVIRONMENTAL CONDITIONS		23 deg.C, 54% RH					
TEST CHANNEL		CH0 (2402MHz)		CH19 (2440MHz)		LIMIT	RESULT
TEST CONDITION	FREQUENCY RANGE	FREQUENCY (MHz)	MEASURE. VALUE	FREQUENCY (MHz)	MEASURE. VALUE		
V <sub>normal</sub>	30.0MHz to 1000.0MHz	917.790	0.002851uW	878.260	0.002588uW	0.25uW	PASS
	1000.0MHz to 2387MHz	2330.470	0.018793uW	1720.540	<b>0.069183uW</b>	2.5uW	PASS
	2387.0MHz to 2400.0MHz	2399.990	1.158777uW	2395.510	<b>0.024604uW</b>	25uW	PASS
	2483.5MHz to 2496.5MHz	2488.860	<b>0.020845uW</b>	2486.810	0.019907uW	25uW	PASS
	2496.5MHz to 12500.0MHz	6978.060	0.045604uW	12494.990	<b>0.046132uW</b>	2.5uW	PASS
V <sub>+10%</sub>	30.0MHz to 1000.0MHz	946.160	0.002844uW	810.360	<b>0.002904uW</b>	0.25uW	PASS
	1000.0MHz to 2387MHz	1722.620	<b>0.035481uW</b>	2355.090	0.019953uW	2.5uW	PASS
	2387.0MHz to 2400.0MHz	2400.000	1.142878uW	2389.870	0.018072uW	25uW	PASS
	2483.5MHz to 2496.5MHz	2487.140	0.019364uW	2492.180	0.019187uW	25uW	PASS
	2496.5MHz to 12500.0MHz	5662.600	<b>0.047534uW</b>	6180.280	0.045499uW	2.5uW	PASS
V <sub>-10%</sub>	30.0MHz to 1000.0MHz	976.960	<b>0.002864uW</b>	806.480	0.002754uW	0.25uW	PASS
	1000.0MHz to 2387MHz	2342.960	0.016482uW	2019.090	0.017061uW	2.5uW	PASS
	2387.0MHz to 2400.0MHz	2400.000	<b>1.199499uW</b>	2387.690	0.020091uW	25uW	PASS
	2483.5MHz to 2496.5MHz	2493.040	0.019275uW	2485.960	<b>0.020559uW</b>	25uW	PASS
	2496.5MHz to 12500.0MHz	4804.800	0.043551uW	11327.080	0.044978uW	2.5uW	PASS

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



ENVIRONMENTAL CONDITIONS		23.5 deg.C, 53.4% RH			
TEST CHANNEL		CH39 (2480MHz)		LIMIT	RESULT
TEST CONDITION	FREQUENCY RANGE	FREQUENCY (MHz)	MEASURE. VALUE		
V <sub>normal</sub>	30.0MHz to 1000.0MHz	933.550	<b>0.002972uW</b>	0.25uW	PASS
	1000.0MHz to 2387MHz	1715.690	0.018281uW	2.5uW	PASS
	2387.0MHz to 2400.0MHz	2397.500	0.01762uW	25uW	PASS
	2483.5MHz to 2496.5MHz	2483.540	0.101859uW	25uW	PASS
	2496.5MHz to 12500.0MHz	10699.370	0.047643uW	2.5uW	PASS
V <sub>+10%</sub>	30.0MHz to 1000.0MHz	929.190	0.00271uW	0.25uW	PASS
	1000.0MHz to 2387MHz	1906.400	0.016904uW	2.5uW	PASS
	2387.0MHz to 2400.0MHz	2387.170	<b>0.01875uW</b>	25uW	PASS
	2483.5MHz to 2496.5MHz	2483.520	<b>0.108893uW</b>	25uW	PASS
	2496.5MHz to 12500.0MHz	10499.300	0.050003uW	2.5uW	PASS
V <sub>-10%</sub>	30.0MHz to 1000.0MHz	857.160	0.002655uW	0.25uW	PASS
	1000.0MHz to 2387MHz	1717.770	<b>0.050003uW</b>	2.5uW	PASS
	2387.0MHz to 2400.0MHz	2395.730	0.016943uW	25uW	PASS
	2483.5MHz to 2496.5MHz	2483.550	0.096161uW	25uW	PASS
	2496.5MHz to 12500.0MHz	11299.580	<b>0.056105uW</b>	2.5uW	PASS

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

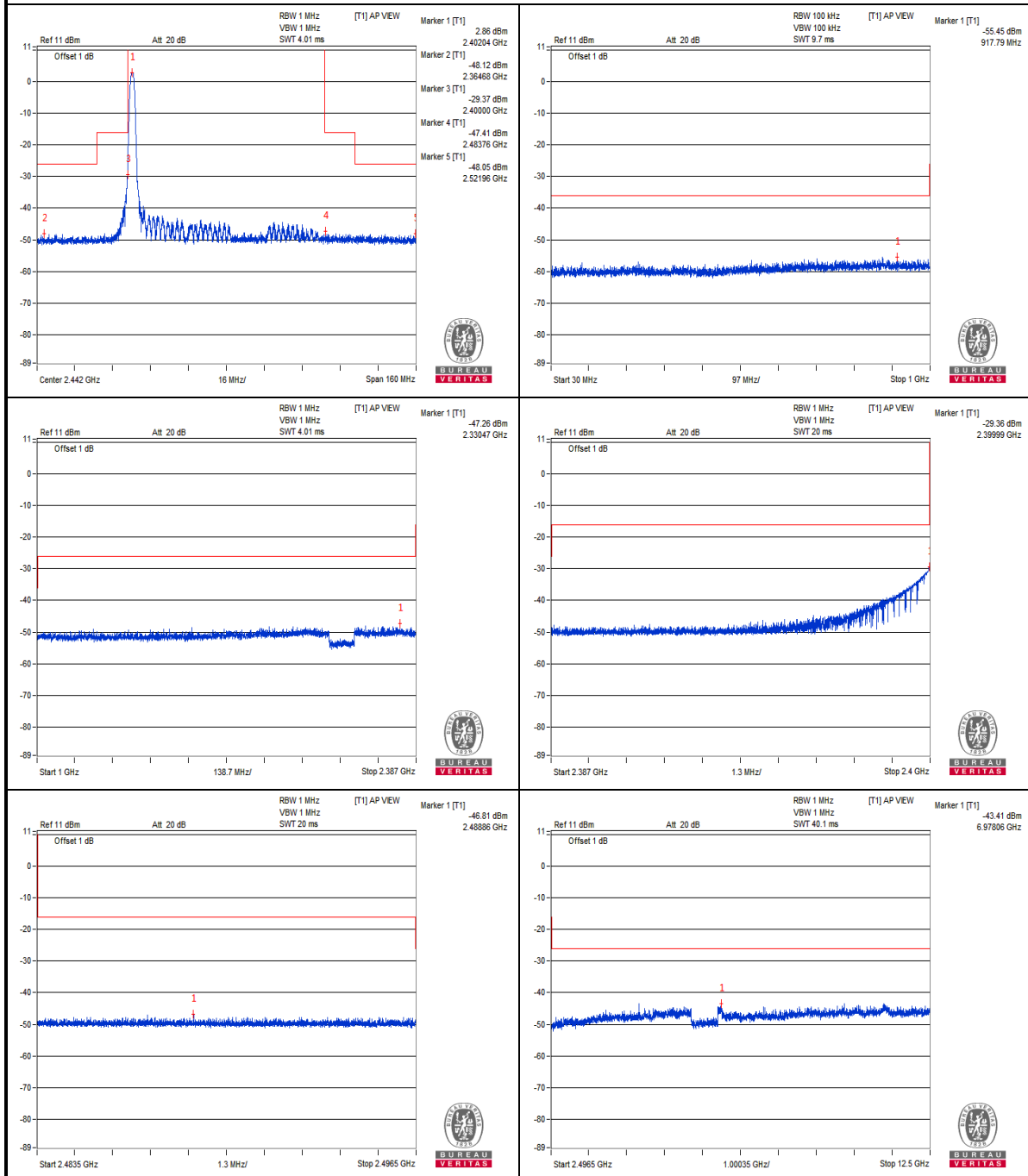
2. The spectrum plots are attached on the following pages.



BUREAU  
VERITAS

Test Report No.: RJ2102WDG0118-1

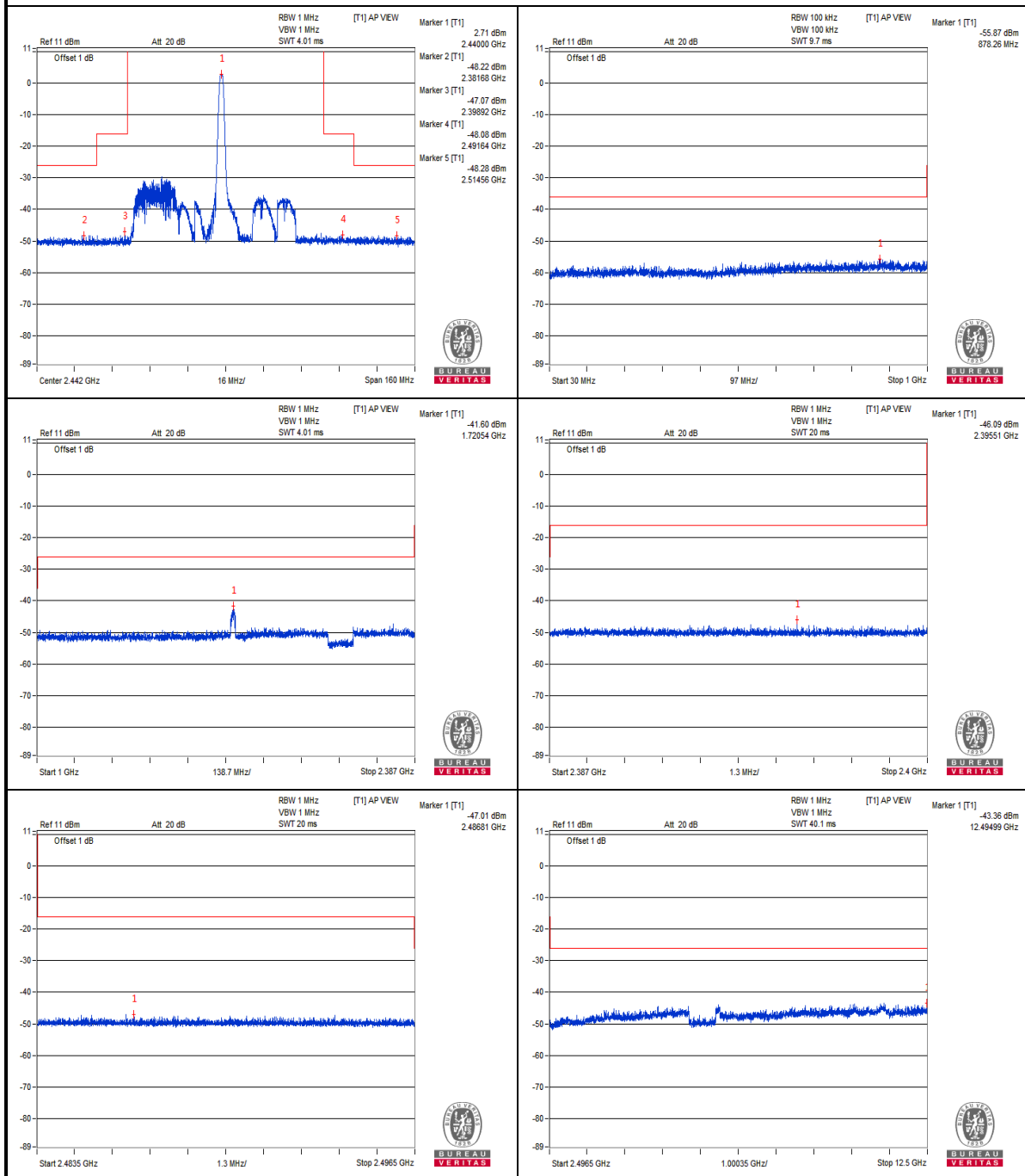
## Vnormal Channel 0



Measurement uncertainty:  $\pm 3.93\text{dB}$



**Vnormal  
Channel 19**



Measurement uncertainty:  $\pm 3.93\text{dB}$

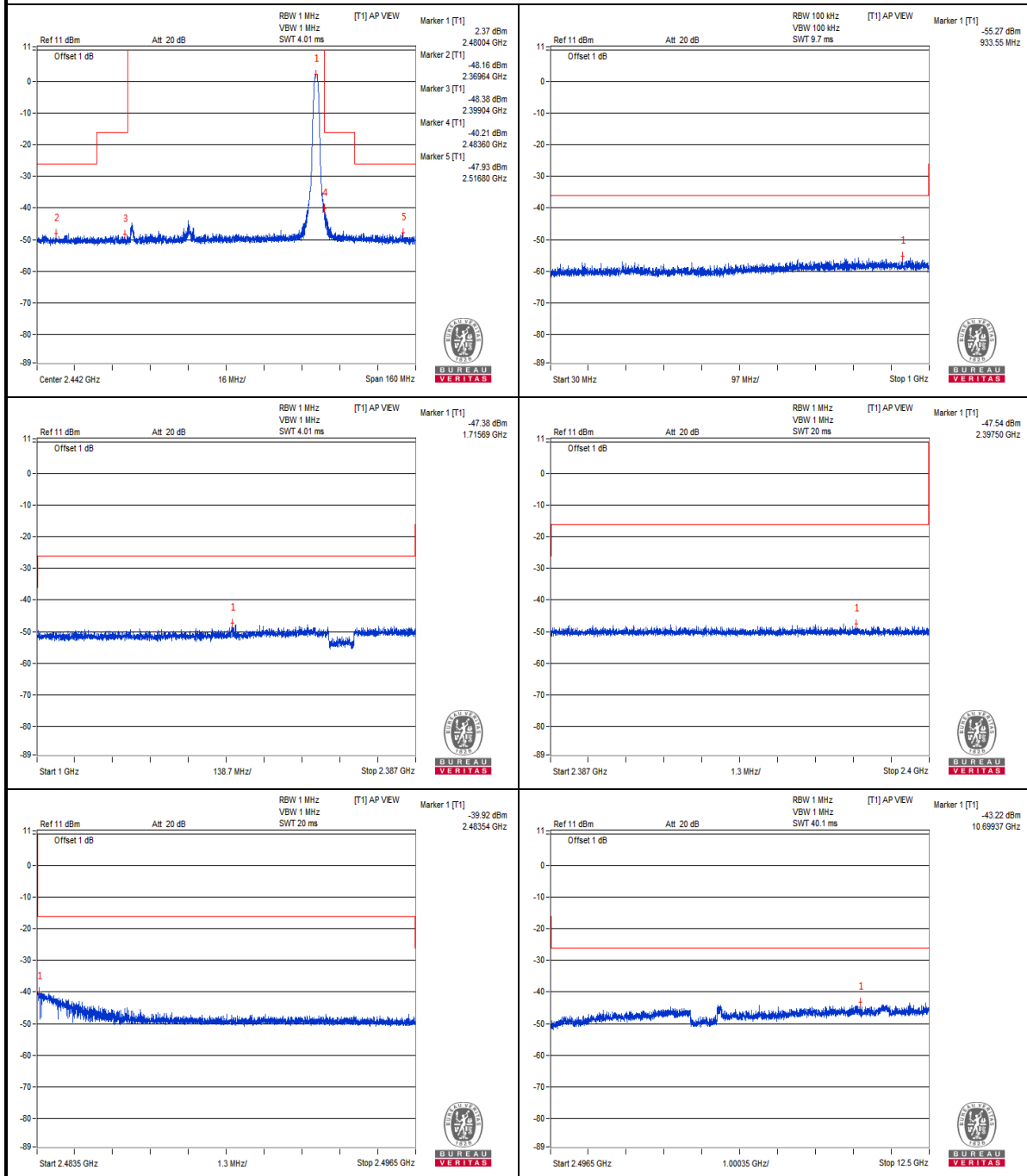




BUREAU  
VERITAS

Test Report No.: RJ2102WDG0118-1

## Vnormal Channel 39



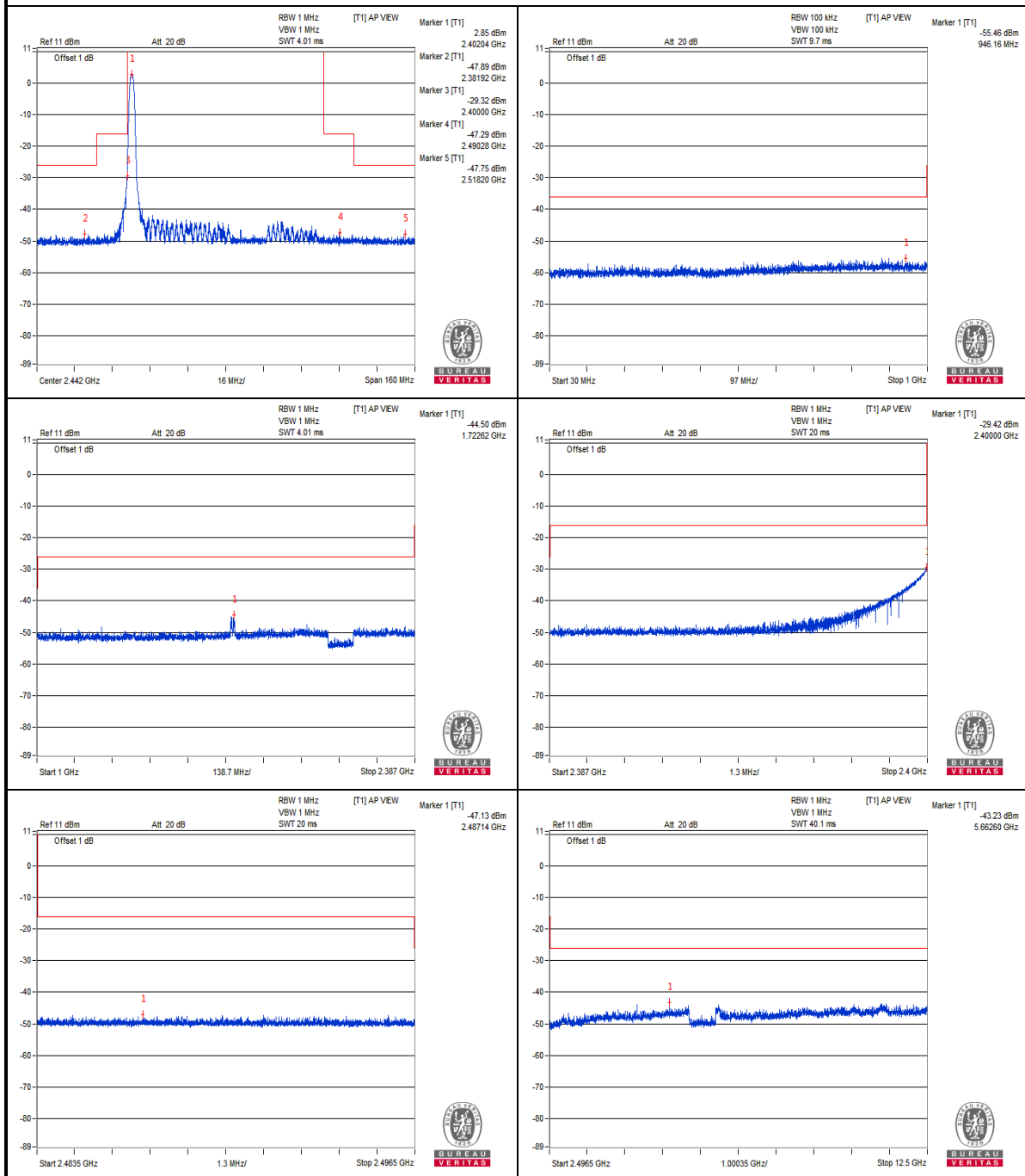
Measurement uncertainty:  $\pm 3.93\text{dB}$



BUREAU  
VERITAS

Test Report No.: RJ2102WDG0118-1

V+10%  
Channel 0



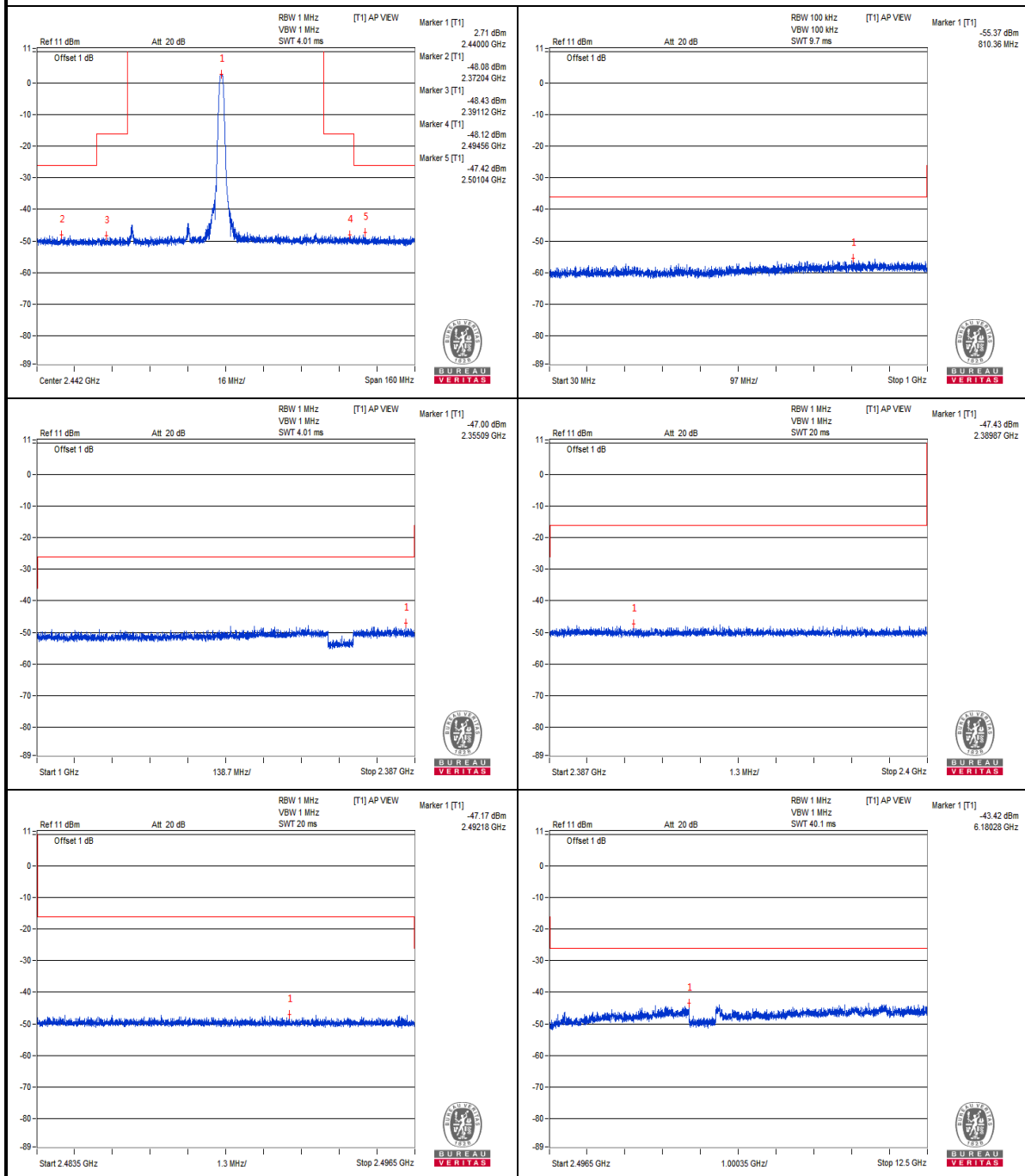
Measurement uncertainty:  $\pm 3.93\text{dB}$



BUREAU  
VERITAS

Test Report No.: RJ2102WDG0118-1

V+10%  
Channel 19



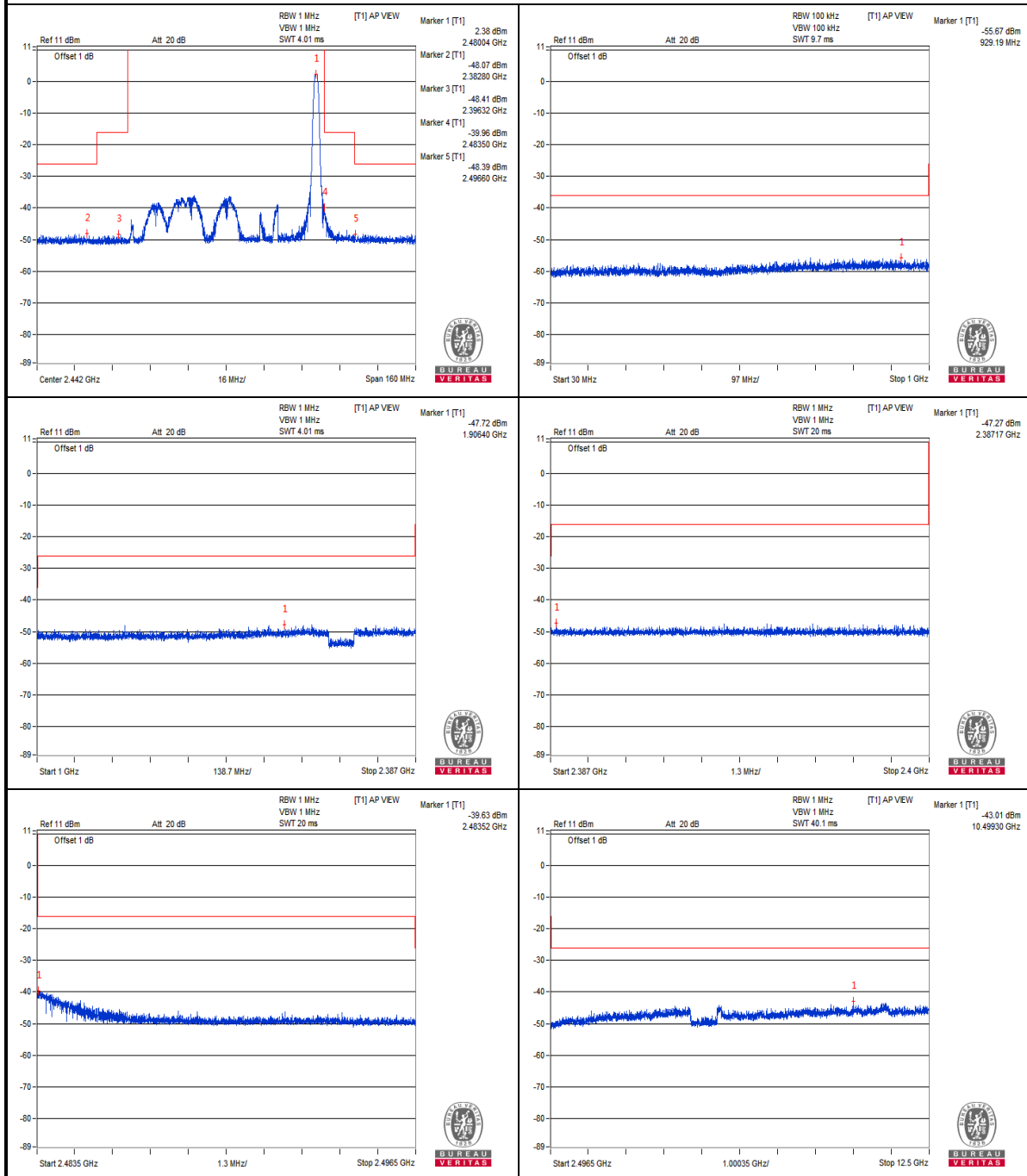
Measurement uncertainty:  $\pm 3.93\text{dB}$



BUREAU  
VERITAS

Test Report No.: RJ2102WDG0118-1

V+10%  
Channel 39



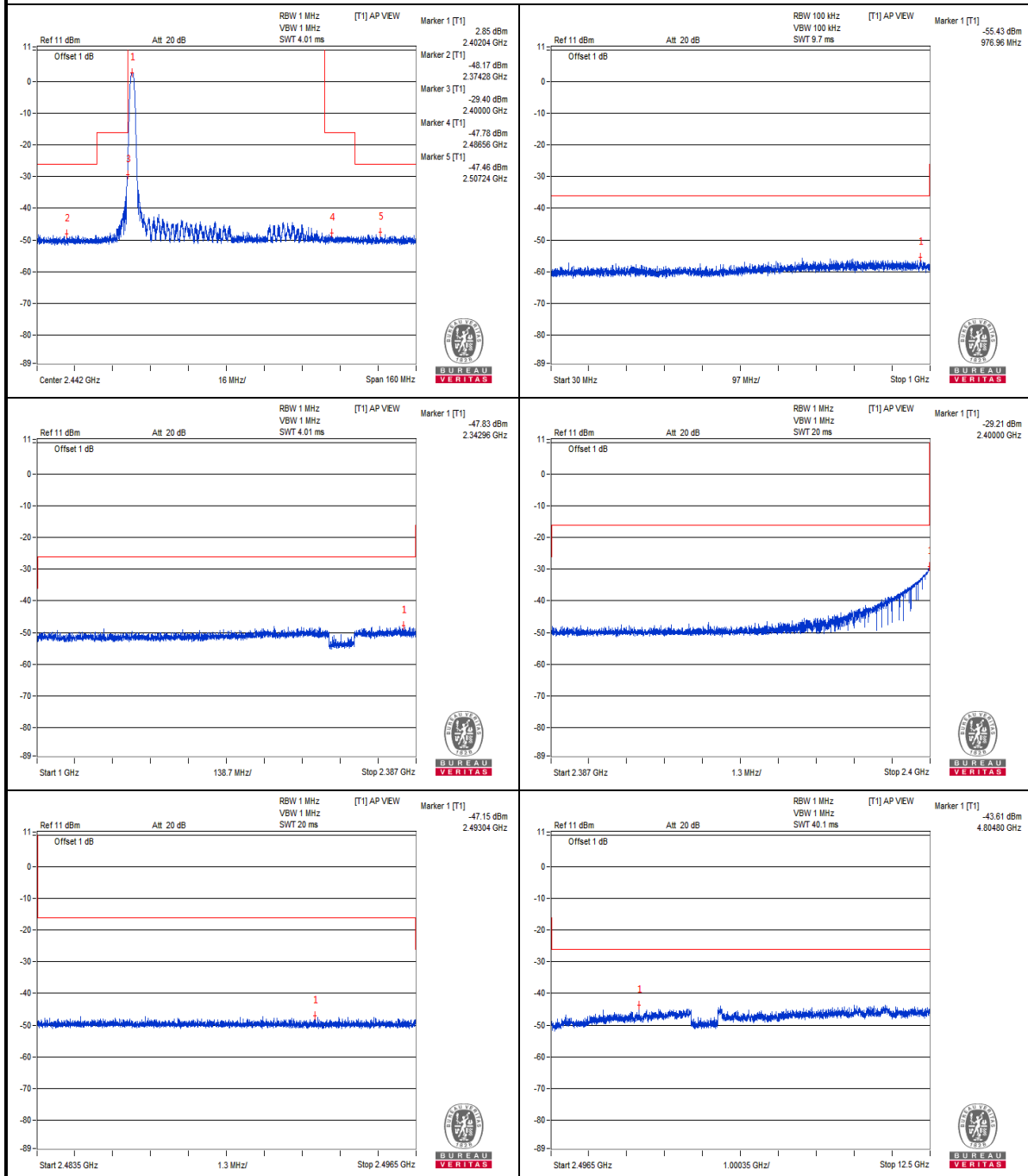
Measurement uncertainty:  $\pm 3.93\text{dB}$



**BUREAU  
VERITAS**

Test Report No.: RJ2102WDG0118-1

## V-10% Channel 0



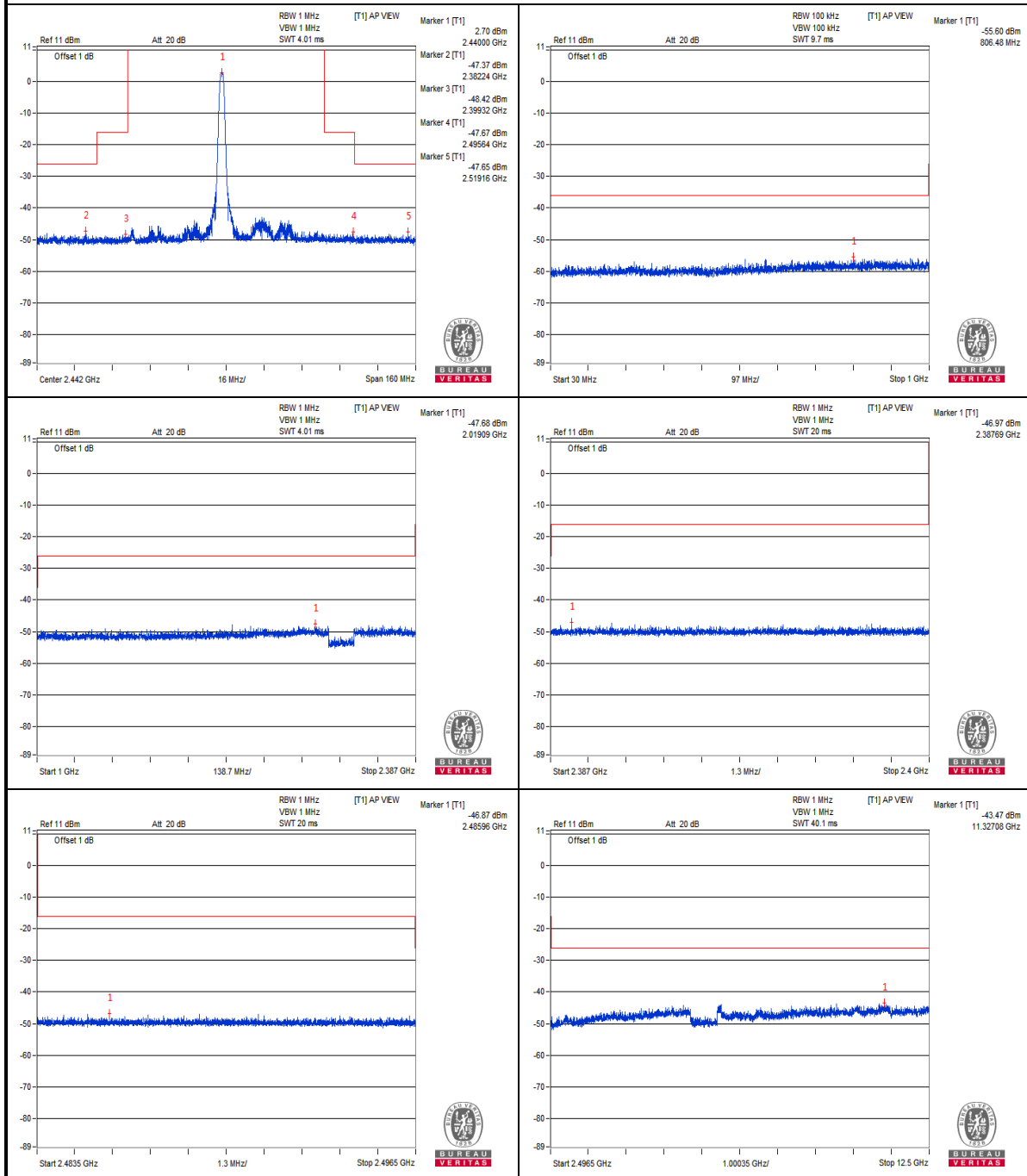
Measurement uncertainty:  $\pm 3.93\text{dB}$



BUREAU  
VERITAS

Test Report No.: RJ2102WDG0118-1

## V-10% Channel 19



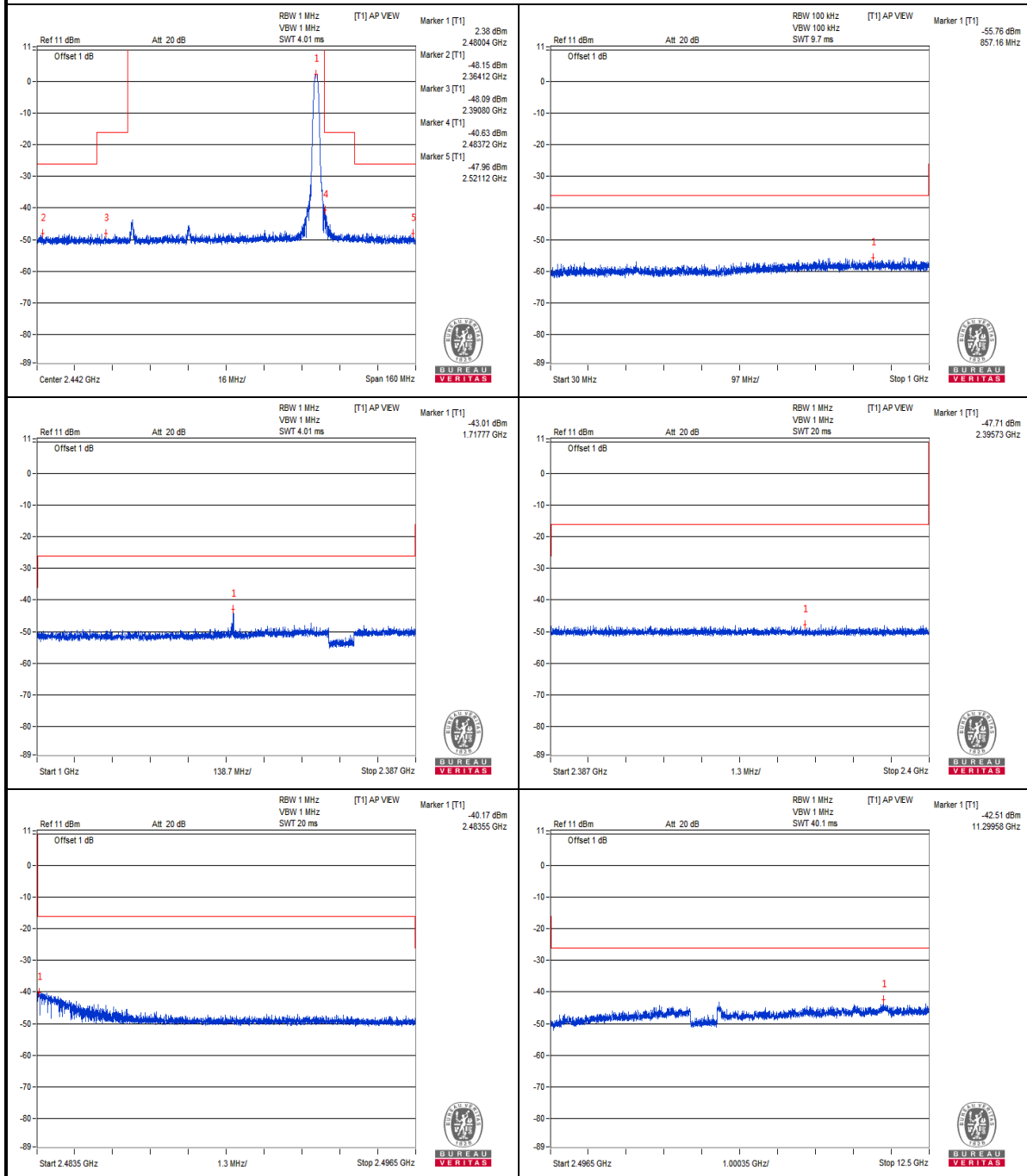
Measurement uncertainty:  $\pm 3.93\text{dB}$



BUREAU  
VERITAS

Test Report No.: RJ2102WDG0118-1

## V-10% Channel 39



Measurement uncertainty:  $\pm 3.93\text{dB}$



### 3.5 ANTENNA POWER MEASUREMENT

#### 3.5.1 LIMITS OF ANTENNA POWER

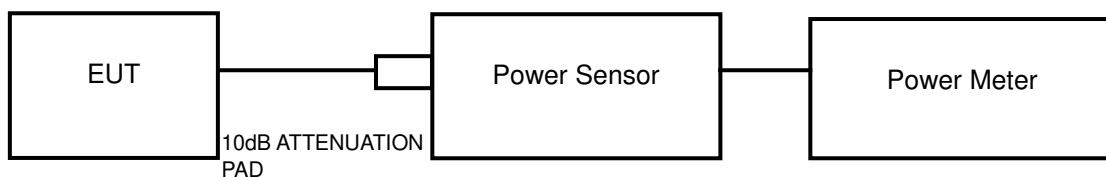
Modulation system	Frequency band used	Antenna power (max.)	EIRP (max)	
			Omni-directional case	Directional case
DS.OFDM (Narrow-Band)	2,400 – 2,4835 MHz	10mW/MHz	12.14 dBm/MHz (16.367 mW/MHz)	22.14 dBm/MHz (163.682 mW/MHz)
OFDM (Wide-Band)	2,400 – 2,4835 MHz	5mW/MHz	9.13dBm/MHz (8.185mW/MHz)	19.13dBm/MHz (81.846mW/MHz)
DTS	2,400 – 2,4835 MHz	10mW	12.14 dBm 16.367 mW	22.14 dBm 163.682 mW

Tolerance of antenna power shall be +20% (upper value) and –80% (lower value).

According article 49.20 f(2) The angular width of the principal radiation in the horizontal and vertical planes of the transmitting antenna shall not exceed the value obtained by the following expression.  $360/A$  degree

A represents the value determined by dividing an equivalent isotropically radiated power by the value obtained by applying an antenna power with the mean power of 10 mW to the transmitting antenna with its absolute gain being 2.14 dB, and shall be 1 when it is lower than 1

#### 3.5.2 TEST SETUP







## 3.5.3 TEST RESULTS

## BT-LE GFSK

ENVIRONMENTAL CONDITIONS	23 deg.C, 54% RH			
TEST CONDITION	Conducted RF output power (mW)			
	CHANNEL 0 2402MHz	CHANNEL 19 2440MHz	CHANNEL 39 2480MHz	MAX. LIMIT (mW)
$V_{normal}$	2.455	2.399	2.280	10
$V_{+10\%}$	2.466	2.432	2.301	10
$V_{-10\%}$	2.427	2.366	2.259	10
RATED POWER	3			
TOLERANCE OF ANTENNA POWER	0.6 ~ 3.6			

ENVIRONMENTAL CONDITIONS	23 deg.C, 54% RH			
TEST CONDITION	EIRP output power (mW)			
	CHANNEL 0 2402MHz	CHANNEL 19 2440MHz	CHANNEL 39 2480MHz	MAX. LIMIT (mW)
$V_{normal}$	2.133	2.085	1.981	16.367
$V_{+10\%}$	2.143	2.113	1.999	16.367
$V_{-10\%}$	2.109	2.056	1.963	16.367

NOTE: 1. The EIRP output power is a “calculated” value derived from the conducted value.

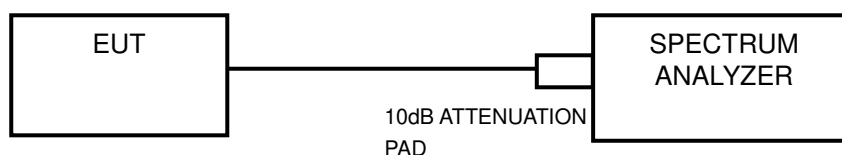
2. Formula: EIRP output power = Conducted RF output power + Antenna Gain.

### 3.6 SPURIOUS EMISSIONS FOR RECEIVER

#### 3.6.1 LIMITS OF SPURIOUS EMISSIONS FOR RECEIVER

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

#### 3.6.2 TEST SETUP





## 3.6.3 SUMMARY OF TEST RESULT

## BT-LE GFSK

DFL-GRK

TEST CHANNEL		CH 0 (2402MHz)		CH 19 (2440MHz)		LIMIT	RESULT
TEST CONDITION	FREQUENCY RANGE	FREQUENCY (MHz)	MEASURE. VALUE	FREQUENCY (MHz)	MEASURE. VALUE		
Vnormal	below 1GHz	829.760	0.024266nW	924.580	0.026182nW	4nW	PASS
	above 1GHz	2477.750	0.489779nW	2477.750	0.490908nW	20nW	PASS
V+10%	below 1GHz	900.570	0.02799nW	851.340	0.022699nW	4nW	PASS
	above 1GHz	1721.620	2.333458nW	2477.750	0.488652nW	20nW	PASS
V-10%	below 1GHz	832.670	0.025942nW	538.760	0.025882nW	4nW	PASS
	above 1GHz	1715.870	8.531001nW	2477.750	0.425598nW	20nW	PASS
TEST CHANNEL		CH 39 (2480MHz)				LIMIT	RESULT
TEST CONDITION	FREQUENCY RANGE	FREQUENCY (MHz)		MEASURE. VALUE			
Vnormal	below 1GHz	980.600		0.026546nW		4nW	PASS
	above 1GHz	2477.750		0.496592nW		20nW	PASS
V+10%	below 1GHz	987.870		0.022909nW		4nW	PASS
	above 1GHz	2477.750		0.530884nW		20nW	PASS
V-10%	below 1GHz	970.410		0.025763nW		4nW	PASS
	above 1GHz	2480.620		0.554626nW		20nW	PASS

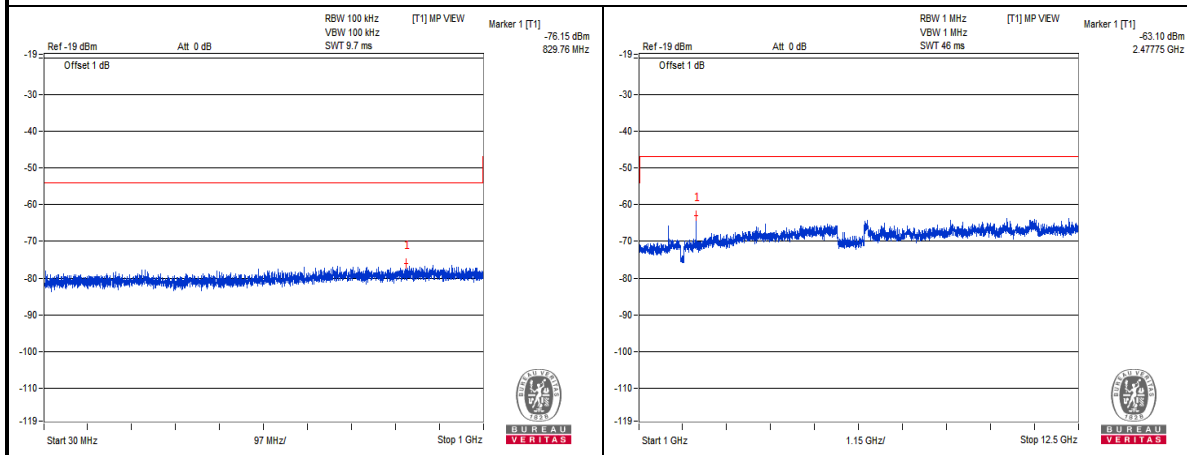
- NOTE:** 1. The worst value in each frequency range v.s. each channel has been marked by boldface.
2. The spectrum plots are attached on the following pages.



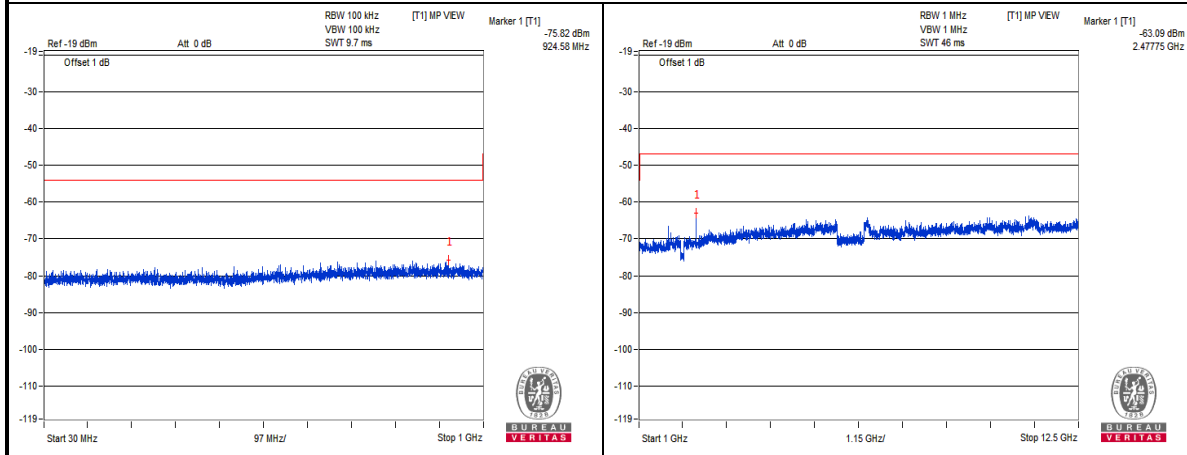
BUREAU  
VERITAS

Test Report No.: RJ2102WDG0118-1

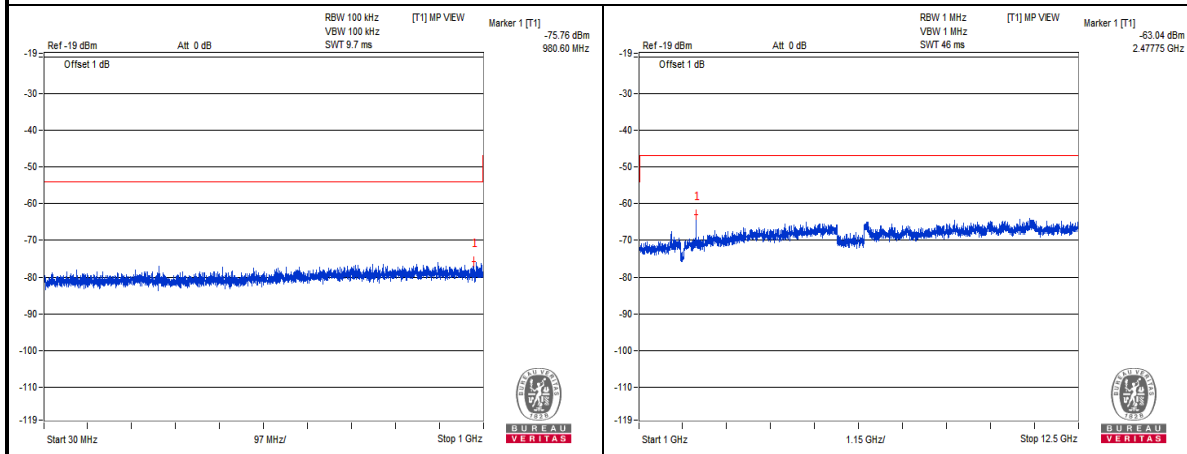
## Vnormal



## Channel 0



## Channel 19



## Channel 39

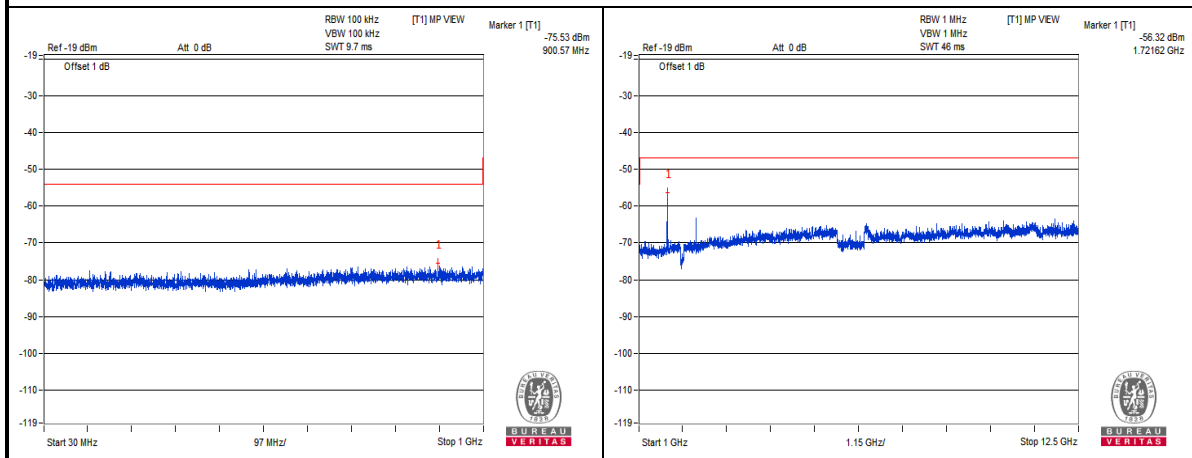
Measurement uncertainty:  $\pm 3.93\text{dB}$



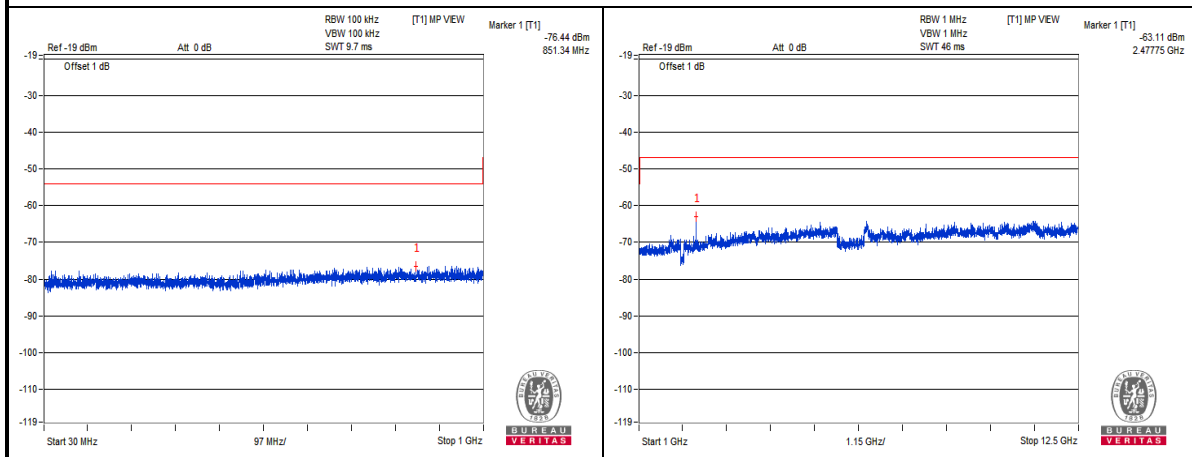
BUREAU  
VERITAS

Test Report No.: RJ2102WDG0118-1

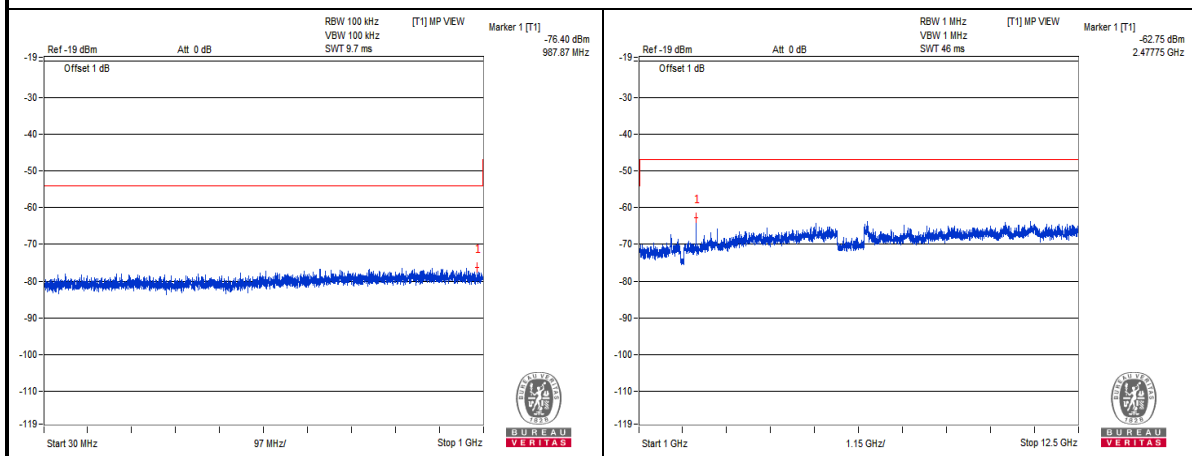
V+10%



Channel 0



Channel 19



Channel 39

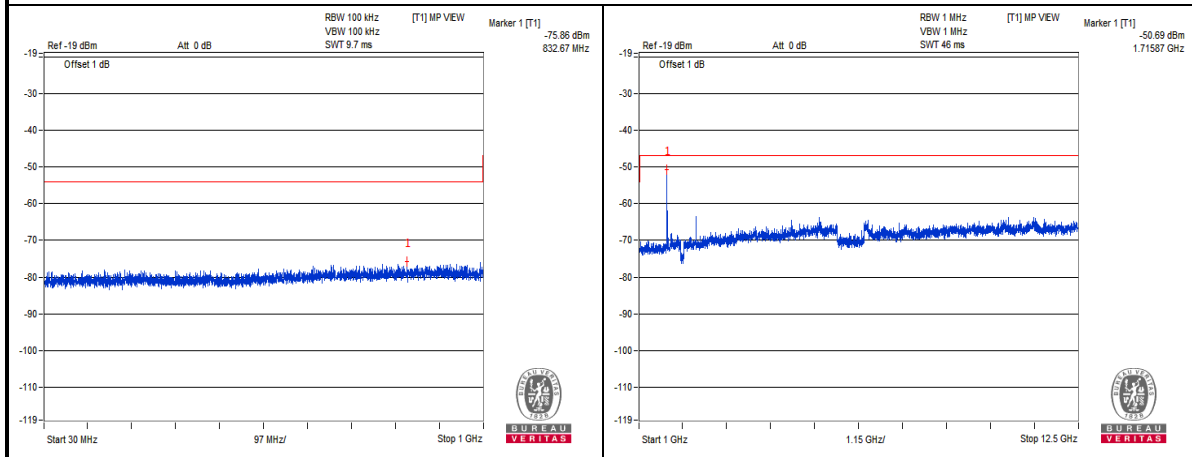
Measurement uncertainty:  $\pm 3.93\text{dB}$



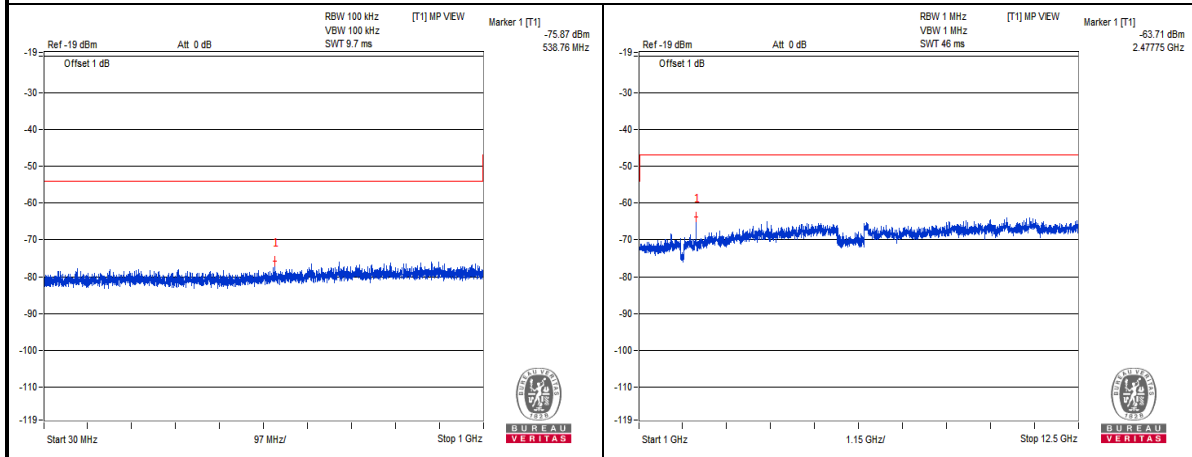
**BUREAU  
VERITAS**

Test Report No.: RJ2102WDG0118-1

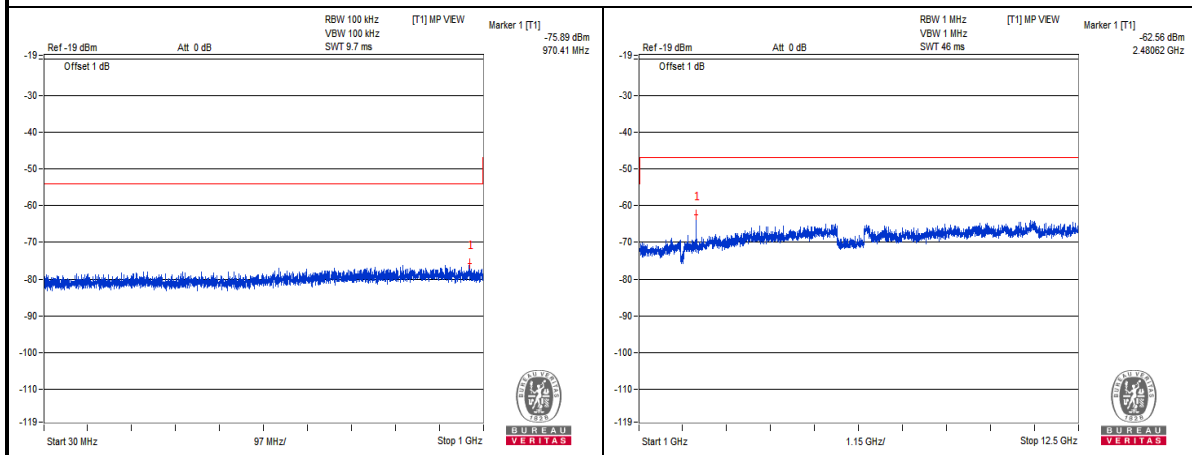
V-10%



Channel 0



Channel 19



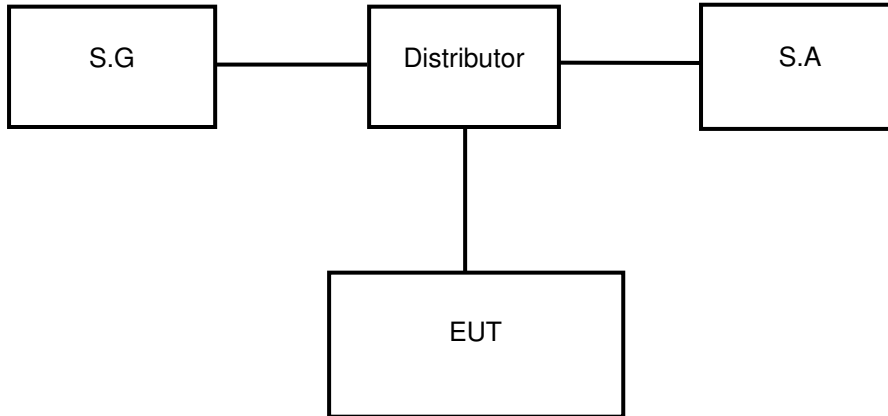
Channel 39

Measurement uncertainty:  $\pm 3.93\text{dB}$



### 3.7 CARRIER SENSE CAPABILITY

#### 3.7.1 MEASURING SYSTEM BLOCK DIAGRAM



#### 3.7.2 MEASURING OPERATION PROCEDURES

- Turn the standard signal generator output OFF. Leave the equipment under test to be ready for transmission and verify the transmission with the spectrum analyzer.
- Set the equipment under test to the receiving state.
- Turn the standard signal generator ON and leave the equipment under test to be ready for transmission and verify with the spectrum analyzer that no transmission is being made.



### 3.7.3 LEVEL OF THE AMBIENT CARRIER

#### BT-LE GFSK

FREQUENCY (MHz)	Pcs (dBm)	C.F (dB)	S.G LEVEL
2402	-45.43	2.30	-43.13
2440	-45.57	2.30	-43.27
2480	-45.71	2.30	-43.41

**NOTE:**

**Pcs (dBm)** =  $22.79 + Gr - 20\log(F)$ .

**Gr:** Antenna gain (**2.4GHz: -0.61dBi**).

**F:** Transmission frequency (MHz).

**CF** = Distributor loss + cable loss.

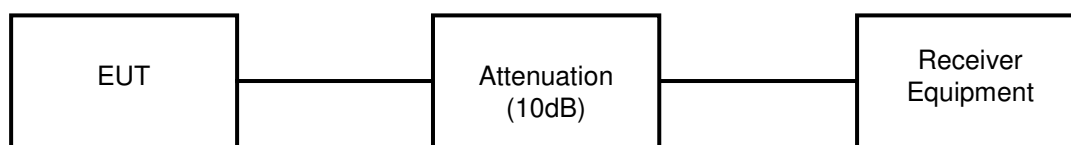


### 3.8 INTERFERENCE PREVENTION FUNCTION

#### 3.8.1 LIMITS OF INTERFERENCE PREVENTION FUNCTION

N/A

#### 3.8.2 TEST SETUP



#### 3.8.3 TEST RESULTS

ENVIRONMENTAL CONDITIONS	23 deg.C, 54% RH
LINK MODE	TEST RESULT
BT-LE	PASS



## 4 TEST INSTRUMENTS

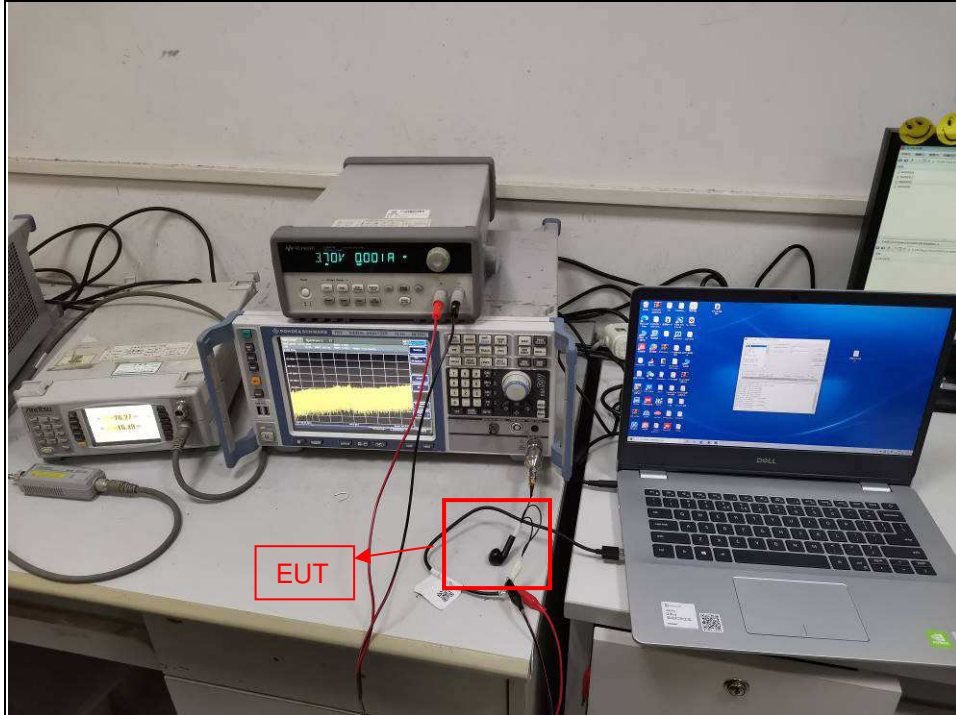
Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
Signal and Spectrum Analyzer	Rohde&Schwarz	FSV40	101094	Apr. 04,22
Power Meter	Anritsu	ML2495A	1139001	Mar. 17,22
Power Sensor	Anritsu	MA2411B	1531155	Mar. 17,22
Digital Multimeter	FLUKE	15B	A1220010DG	Oct.12, 21
DC Source	Keysight	E3642A	MY56146098	N/A
Attenuator	MINI	BW-S10W2+	S130129FGE2	N/A

**NOTES:**

1. The test was performed in RF Ovenroom.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.



## 5 PHOTOGRAPHS OF THE TEST CONFIGURATION





## **6 APPENDIX A – MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB**

No any modifications were made to the EUT by the lab during the test.

**--- END ---**