



BUREAU
VERITAS

Test Report No.: PSU-NQN2502190114RF01



Certificate #6613.01

FCC TEST REPORT

(Part 15, Subpart C)

Applicant:	Jiangsu Toppower Automotive Electronics Co.,Ltd.
Address:	No.19,Fenghuang Avenue, Xuzhou Economic and Technological Development Zone, Xuzhou City ,221000 Jiangsu,P.R.China

Manufacturer or Supplier:	Jiangsu Toppower Automotive Electronics Co.,Ltd.
Address:	No.19,Fenghuang Avenue, Xuzhou Economic and Technological Development Zone, Xuzhou City ,221000 Jiangsu,P.R.China
Product:	Cell Monitoring Unit
Brand Name:	YFVE
Model Name:	CMU
FCC ID:	2BNQR-CMU
Date of tests:	Apr.30, 2024 ~ Jun. 27, 2024

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

- ☒ FCC Part 15, Subpart C, Section 15.247
- ☒ ANSI C63.10-2020

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

Prepared by Hanwen Xu Engineer / Mobile Department	Approved by Peibo Sun Manager / Mobile Department
 Date: Jun. 27, 2024	 Date: Jun. 27, 2024

This report is governed by, and incorporates by reference, the Conditions of Testing as posted at the date of issuance of this report at <http://www.bureauveritas.com/home/about-us/our-business/cps/about-us/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. Statements of conformity are based on simple acceptance criteria without taking measurement uncertainty into account, unless otherwise requested in writing. 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

RELEASE CONTROL RECORD	5
1 SUMMARY OF TEST RESULTS.....	6
1.1 MEASUREMENT UNCERTAINTY	7
2 GENERAL INFORMATION	8
2.1 GENERAL DESCRIPTION OF EUT	8
2.2 DESCRIPTION OF TEST MODES	9
2.2.1 CONFIGURATION OF SYSTEM UNDER TEST	10
2.2.2 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL.....	10
2.3 DUTY CYCLE OF TEST SIGNAL	12
2.4 GENERAL DESCRIPTION OF APPLIED STANDARDS	13
2.5 DESCRIPTION OF SUPPORT UNITS	13
3 TEST TYPES AND RESULTS.....	14
3.1 CONDUCTED EMISSION MEASUREMENT	14
3.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT	14
3.1.2 TEST INSTRUMENTS.....	14
3.1.3 TEST PROCEDURES	15
3.1.4 DEVIATION FROM TEST STANDARD	15
3.1.5 TEST SETUP	16
3.1.6 EUT OPERATING CONDITIONS	16
3.1.7 TEST RESULTS	17
3.2 RADIATED EMISSION MEASUREMENT	18
3.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT	18
3.2.2 TEST INSTRUMENTS.....	19
3.2.3 TEST PROCEDURES	20
3.2.4 DEVIATION FROM TEST STANDARD	20
3.2.5 TEST SETUP	21
3.2.6 EUT OPERATING CONDITIONS	22
3.2.7 TEST RESULTS	23
Radiated Emission Band Edge	23
Sample Calculations	26
3.3 6 dB BANDWIDTH MEASUREMENT	34
3.3.1 LIMITS OF 6dB BANDWIDTH MEASUREMENT	34
3.3.2 TEST INSTRUMENTS.....	34



3.3.3	TEST PROCEDURE.....	35
3.3.4	DEVIATION FROM TEST STANDARD	36
3.3.5	TEST SETUP	36
3.3.6	EUT OPERATING CONDITIONS	36
3.3.7	TEST RESULTS	37
3.4	CONDUCTED OUTPUT POWER.....	38
3.4.1	LIMITS OF CONDUCTED OUTPUT POWER MEASUREMENT	38
3.4.2	TEST SETUP	38
3.4.3	TEST INSTRUMENTS.....	38
3.4.4	TEST PROCEDURES	38
3.4.5	DEVIATION FROM TEST STANDARD	38
3.4.6	EUT OPERATING CONDITIONS	38
3.4.7	TEST RESULTS	39
3.4.7.1	MAXIMUM PEAK OUTPUT POWER	39
3.4.7.2	AVERAGE OUTPUT POWER (FOR REFERENCE).....	40
3.5	POWER SPECTRAL DENSITY MEASUREMENT	41
3.5.1	LIMITS OF POWER SPECTRAL DENSITY MEASUREMENT	41
3.5.2	TEST SETUP	41
3.5.3	TEST INSTRUMENTS.....	41
3.5.4	TEST PROCEDURE.....	41
3.5.5	DEVIATION FROM TEST STANDARD	41
3.5.6	EUT OPERATING CONDITION	41
3.5.7	TEST RESULTS	42
3.6	OUT OF BAND EMISSION MEASUREMENT	43
3.6.1	LIMITS OF OUT OF BAND EMISSION MEASUREMENT	43
3.6.2	TEST SETUP	43
3.6.3	TEST INSTRUMENTS.....	43
3.6.4	TEST PROCEDURE.....	43
3.6.5	DEVIATION FROM TEST STANDARD	44
3.6.6	EUT OPERATING CONDITION	44
3.6.7	TEST RESULTS	44
3.7	ANTENNA REQUIREMENTS.....	45
3.7.1	STANDARD APPLICABLE	45
3.7.2	ANTENNA CONNECTED CONSTRUCTION	45
3.7.3	ANTENNA GAIN	45
4	PHOTOGRAPHS OF THE TEST CONFIGURATION	45



5	MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB45	
6	APPENDIX.....	46
DTS.....		46
DTS BANDWIDTH		46
Test Result		46
Test Graphs.....		46
OCCUPIED CHANNEL BANDWIDTH		47
Test Result		47
Test Graphs.....		47
MAXIMUM CONDUCTED OUTPUT POWER.....		48
Test Result		48
MAXIMUM POWER SPECTRAL DENSITY		49
Test Result		49
Test Graphs.....		49
BAND EDGE MEASUREMENTS		50
Test Result		50
CONDUCTED SPURIOUS EMISSION		51
Test Result		51
DUTY CYCLE.....		52
Test Result		52
Test Graphs.....		52



Test Report No.: PSU-NQN2502190114RF01

RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
PSU-NQN2502190114RF01	Original release	Jun. 27, 2024



1 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC PART 15, SUBPART C (SECTION 15.247)		
STANDARD SECTION	TEST TYPE AND LIMIT	RESULT
15.207	AC Power Conducted Emission	Compliance
15.205 15.209	Radiated Emissions	Compliance
15.247(d)	Out of band Emission Measurement	Compliance
15.247(a)(2)	6dB bandwidth	Compliance
15.247(b)	Conducted Output power	Compliance
15.247(e)	Power Spectral Density	Compliance
15.203	Antenna Requirement	Compliance

Note : 1.Except RSE, other data please refer to Appendix 1 (for DTS).

*Test Lab Information Reference

Lab A:

Huarui 7Layers High Technology (Suzhou) Co., Ltd.

Lab Address:

Tower N, Innovation Center, 88 Zuyi Road, High-tech District, Suzhou City, Anhui Province

Accredited Test Lab Cert 6613.01

The FCC Site Registration No. is 434559; The Designation No. is CN1325.

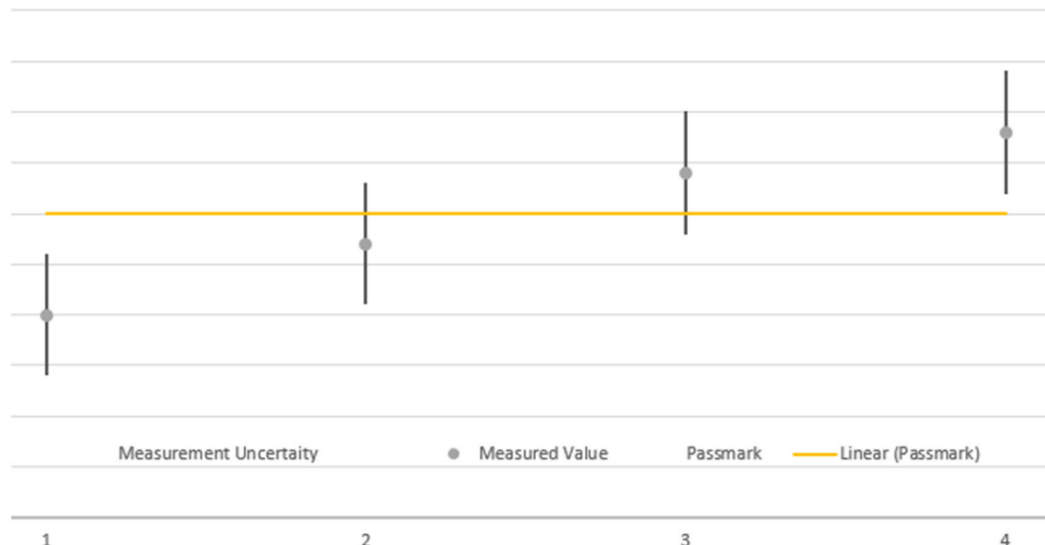


1.1 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

MEASUREMENT	UNCERTAINTY
AC Power Conducted emissions	$\pm 2.70\text{dB}$
Radiated emissions (9KHz~30MHz)	$\pm 2.68\text{dB}$
Radiated emissions (30MHz~1GHz)	$\pm 4.98\text{dB}$
Radiated emissions (1GHz ~6GHz)	$\pm 4.70\text{dB}$
Radiated emissions (6GHz ~18GHz)	$\pm 4.60\text{dB}$
Radiated emissions (18GHz ~40GHz)	$\pm 4.12\text{dB}$
Conducted emissions	$\pm 4.01\text{dB}$
Occupied Channel Bandwidth	$\pm 43.58\text{KHz}$
Conducted Output power	$\pm 2.06\text{dB}$
Power Spectral Density	$\pm 0.85\text{ dB}$

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



The verdicts in this test report are given according the above diagram:

Case	Measured Value	Uncertainty Range	Verdict
1	below pass mark	below pass mark	Passed
2	below pass mark	within pass mark	Passed
3	above pass mark	within pass mark	Failed
4	above pass mark	above pass mark	Failed

That means, the laboratory applies, as decision rule (see ISO/IEC 17025:2017), the so-called shared risk principle.



2 GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

PRODUCT*	Cell Monitoring Unit
BRAND NAME*	YFVE
MODEL NAME*	CMU
NOMINAL VOLTAGE*	29.6Vdc(DC supply)
MODULATION *	GFSK
OPERATING FREQUENCY	2410-2475MHz
MAX. OUTPUT POWER	DTS: 8.97 mW (Maximum)
ANTENNA TYPE*	Passive Antenna with 4.6dBi dBi gain for DTS
HW VERSION*	VPKAMF-14E115-DAB
SW VERSION*	ADI 2.0.4
I/O PORTS*	Refer to user's manual

NOTE:

- *Since the above data and/or information is provided by the client relevant results or conclusions of this report are only made for these data and/or information, Test Lab is not responsible for the authenticity, integrity and results of the data and information and/or the validity of the conclusion.
- For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
- The EUT incorporates a SISO function. Physically, the EUT provides two transmitter and two receiver.

MODULATION MODE	TX/RX FUNCTION
GFSK	1TX /1RX

- For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.
- Antenna gain and EUT conducted cable loss are provided by the customer, and the laboratory will record the results based on these items that involve these two parameters.



2.2 DESCRIPTION OF TEST MODES

13 channels are provided for GFSK:

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
1	2410 MHz	8	2450 MHz
2	2415 MHz	9	2455 MHz
3	2420 MHz	10	2460 MHz
4	2425 MHz	11	2465 MHz
5	2430 MHz	12	2470 MHz
6	2435 MHz	13	2475 MHz
7	2445 MHz		



2.2.1 CONFIGURATION OF SYSTEM UNDER TEST

Please see section 4 photographs of the test configuration for reference.

2.2.2 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports.
The worst case was found when positioned on Y axis for radiated emission. Following test modes were selected for the final test, and the final worst case is marked in boldface and recorded in the report:

EUT CONFIGURE MODE	APPLICABLE TO				MODE
	RE<1G	RE≥1G	PLC	APCM	
-	√	√	√	√	-

Where **RE<1G**: Radiated Emission below 1GHz **RE≥1G**: Radiated Emission above 1GHz
PLC: Power Line Conducted Emission **APCM**: Antenna Port Conducted Measurement

NOTE: No need to concern of Conducted Emission due to the EUT is powered by battery.

RADIATED EMISSION TEST (BELOW 1GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ The following channel(s) was (were) selected for the final test as listed below.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)
GFSK	1 to 13	7	GFSK	MCS0

**RADIATED EMISSION TEST (ABOVE 1GHz):**

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ The following channel(s) was (were) selected for the final test as listed below.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)
GFSK	1 to 13	1, 7 13	GFSK	1.0

POWER LINE CONDUCTED EMISSION TEST

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ The following channel(s) was (were) selected for the final test as listed below.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)
GFSK	1 to 13	1, 7 13	GFSK	1.0

BANDEDGE MEASUREMENT:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ The following channel(s) was (were) selected for the final test as listed below.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)
GFSK	1 to 13	1, 7 13	GFSK	1.0

ANTENNA PORT CONDUCTED MEASUREMENT:

☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ The following channel(s) was (were) selected for the final test as listed below.

N/A



2.3 DUTY CYCLE OF TEST SIGNAL

Please Refer to Appendix1/2 Of this test report.



2.4 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC Part 15, Subpart C, Section 15.247

KDB 558074 D01 DTS Meas Guidance v05r02

ANSI C63.10-2020

Note :

1. All test items have been performed and recorded as per the above standards.
2. The EUT is also considered as a kind of computer peripheral, because the connection to computer is necessary for typical use. It has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (Certification). The test report has been issued separately.

2.5 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.



3 TEST TYPES AND RESULTS

3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dB μ V)	
	Quasi-peak	Average
0.15 ~ 0.5	66 to 56	56 to 46
0.5 ~ 5	56	46
5 ~ 30	60	50

- NOTE:** 1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.
3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

3.1.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESR3	102749	Mar.28,24	Mar.27,26
ELEKTRA test software	Rohde&Schwarz	ELEKTRA	NA	N/A	N/A
LISN network	Rohde&Schwarz	ENV216	102640	Mar.28,24	Mar.27,26
CABLE	Rohde&Schwarz	W61.01	N/A	Apr.27,24	Apr.26,25
CABLE	Rohde&Schwarz	W601	N/A	Apr.27,24	Apr.26,25

NOTE:

1. The test was performed in CE shielded room.
2. The calibration interval of the above test instruments is 12 /24months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.



3.1.3 TEST PROCEDURES

- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

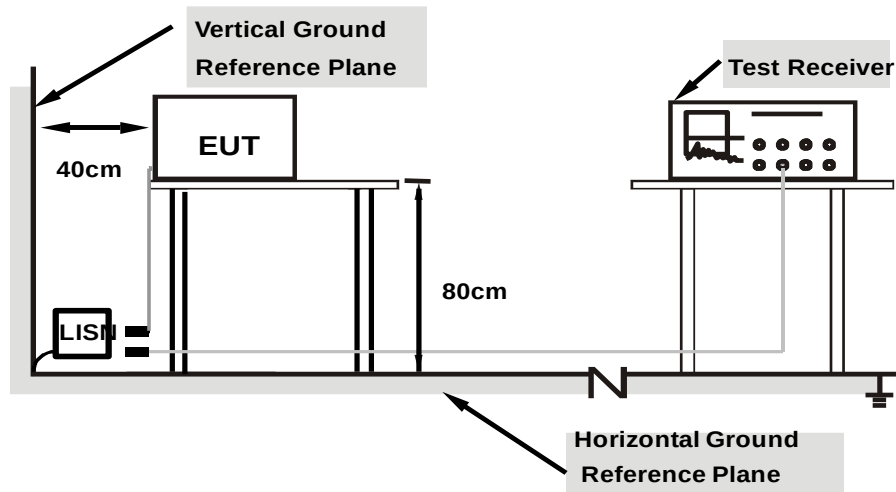
NOTE: All modes of operation were investigated and the worst-case emissions are reported.

3.1.4 DEVIATION FROM TEST STANDARD

No deviation.



3.1.5 TEST SETUP



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80
from other units and other metal planes

For the actual test configuration, please refer to the attached file (Test Setup Photo).

3.1.6 EUT OPERATING CONDITIONS

- Turned on the power and connected of all equipment.
- EUT was operated according to the type used was description in manufacturer's specifications or the User's Manual.



BUREAU VERITAS Test Report No.: PSU-NQN2502190114RF01

3.1.7 TEST RESULTS

N/A



3.2 RADIATED EMISSION MEASUREMENT

3.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).

FREQUENCIES (MHz)	FIELD STRENGTH (microvolts/meter)	MEASUREMENT DISTANCE (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.



3.2.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Pre-Amplifier	R&S	SCU18F1	100815	Aug.30,23	Aug.29,25
Pre-Amplifier	R&S	SCU08F1	101028	Jan.22,24	Jan.21,26
Signal Generator	R&S	SMB100A	182185	Mar.29,24	Mar.28,26
3m Fully-anechoic Chamber	TDK	9m*6m*6m	HRSW-SZ-EMC-01Chamber	Nov.25,22	Nov.24,25
3m Semi-anechoic Chamber	TDK	9m*6m*6m	HRSW-SZ-EMC-02Chamber	Nov.25,22	Nov.24,25
EMI TEST Receiver	R&S	ESW44	101973	Mar.28,24	Mar.27,26
Bilog Antenna	SCHWARZBECK	VULB 9163	1264	Dec.26,23	Dec.25,25
Horn Antenna	ETS-LINDGREN	3117	227836	Aug.22,23	Aug.21,25
Horn Antenna (18GHz-40GHz)	Steatite Q-par Antennas	QMS 00880	23486	Jul.15,24	Jul.14,26
Horn Antenna	Steatite Q-par Antennas	QMS 00208	23485	Aug.22,23	Aug.21,25
Loop Antenna	SCHWARZ	HFH2-Z2/Z2E	100976	Feb.23,23	Feb.22,25
WIDEBANDRADIO COMMUNICATION TESTER	R&S	CMW500	169399	Jun.19,24	Jun.18,26
Test Software	ELEKTRA	ELEKTRA4.32	N/A	N/A	N/A
Open Switch and Control Unit	R&S	OSP220	101964	N/A	N/A
DC Source	HYELEC	HY3010B	551016	Aug.31,23	Aug.30,25
Hygrothermograph	DELI	20210528	SZ014	Sep.06,23	Sep.05,25
6DB attenuator	Tonscend Technology Co., Ltd	N/A	23062787	N/A	N/A
PC	LENOVO	E14	HRSW0024	N/A	N/A
TMC-AMI18843A(CABLE)	R&S	HF290-NMNM-7.00M	N/A	N/A	N/A
TMC-AMI18843A(CABLE)	R&S	HF290-NMNM-4.00M	N/A	N/A	N/A
CABLE	R&S	W13.02	N/A	Apr.27,24	Apr.26,25
CABLE	R&S	W12.14	N/A	Apr.27,24	Apr.26,25

- NOTE:**
1. The calibration interval of the above test instruments is 12/ 24/ 36 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
 2. The test was performed in 3m Chamber.
 3. The FCC Site Registration No. is 434559; The Designation No. is CN1325.



3.2.3 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 0.8 meters (for below 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, For battery operated equipment, the equipment tests shall be perform using fresh batteries. The turntable was rotated to maximize the emission level.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average (Duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor ($10 \log(1/\text{duty cycle})$).
4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (Duty cycle $\geq 98\%$) for Average detection (AV) at frequency above 1GHz.
5. All modes of operation were investigated and the worst-case emissions are reported.

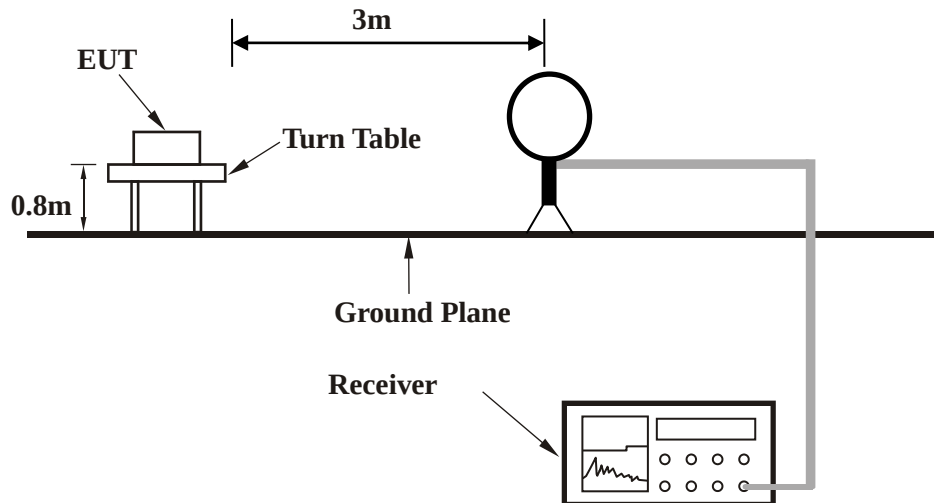
3.2.4 DEVIATION FROM TEST STANDARD

No deviation

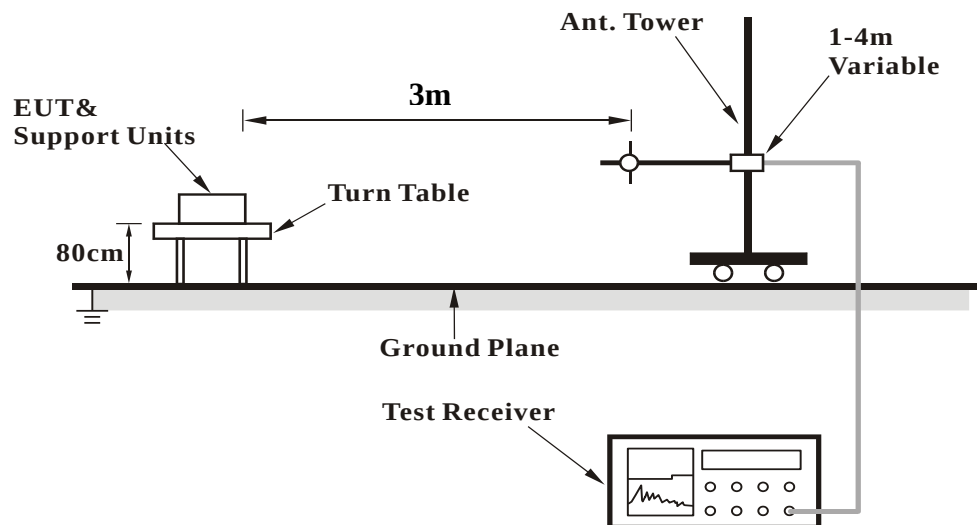


3.2.5 TEST SETUP

<Frequency Range 9KHz~30MHz >

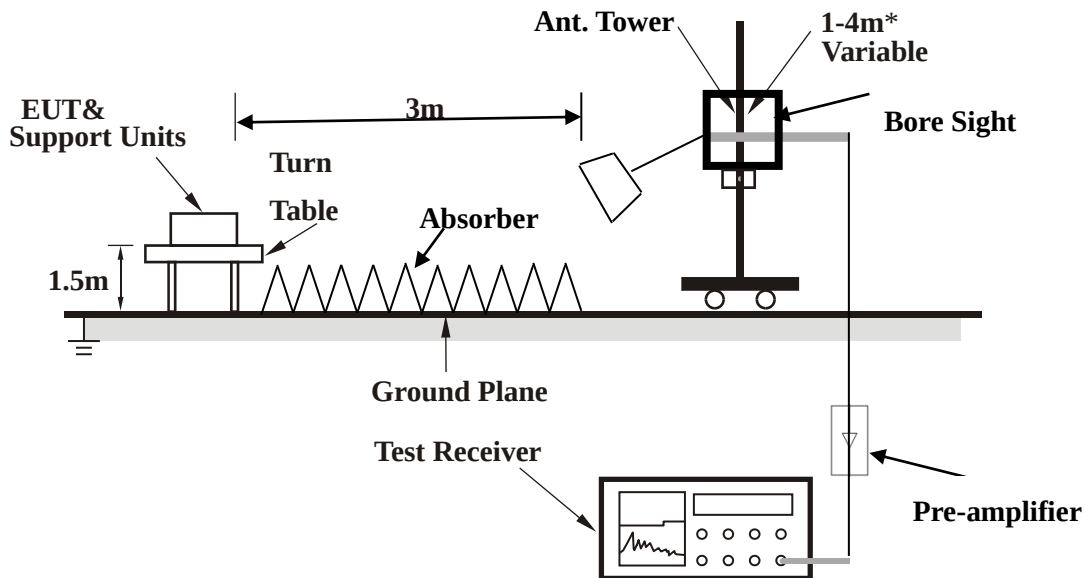


< Frequency Range 30MHz~1GHz >





<Frequency Range above 1GHz>



Note: Above 1G is a directional antenna

Depends on the EUT height and the antenna 3dB beamwidth both, refer to section 7.3 of CISPR 16-2-3.

For the actual test configuration, please refer to the attached file (Test Setup Photo).

3.2.6 EUT OPERATING CONDITIONS

- Set the EUT under full load condition and placed them on a testing table.
- Set the transmitter part of EUT under transmission condition continuously at specific channel frequency.
- The necessary accessories enable the EUT in full functions.



BUREAU
VERITAS

Test Report No.: PSU-NQN2502190114RF01

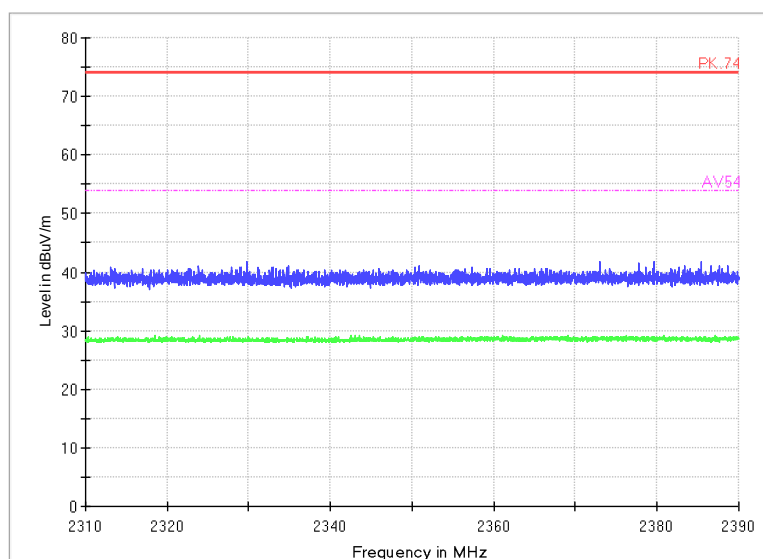
3.2.7 TEST RESULTS

NOTE : The 9K~30MHz amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required in the report.

BELOW 1GHz WORST-CASE DATA:

30 MHz – 1GHz data:

Radiated Emission Band Edge



Radiated Emission Band Edge

Carrier frequency (MHz):2410

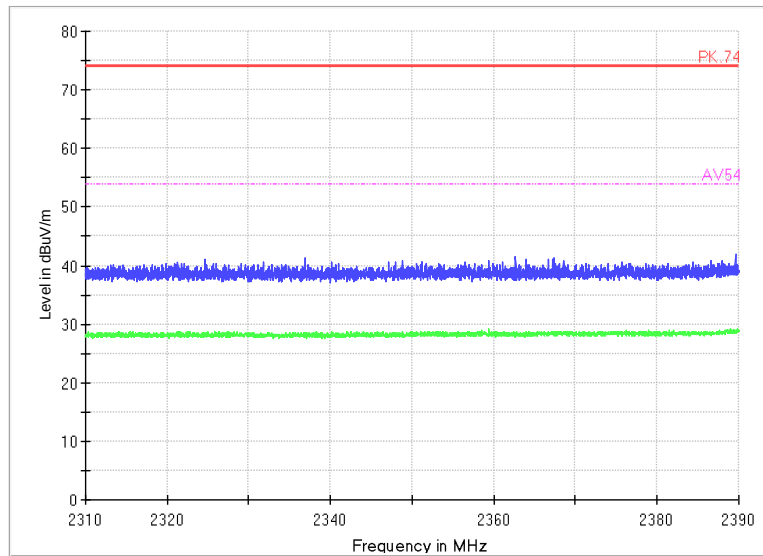
Test Mode: GFSK

Polarization : V



BUREAU
VERITAS

Test Report No.: PSU-NQN2502190114RF01

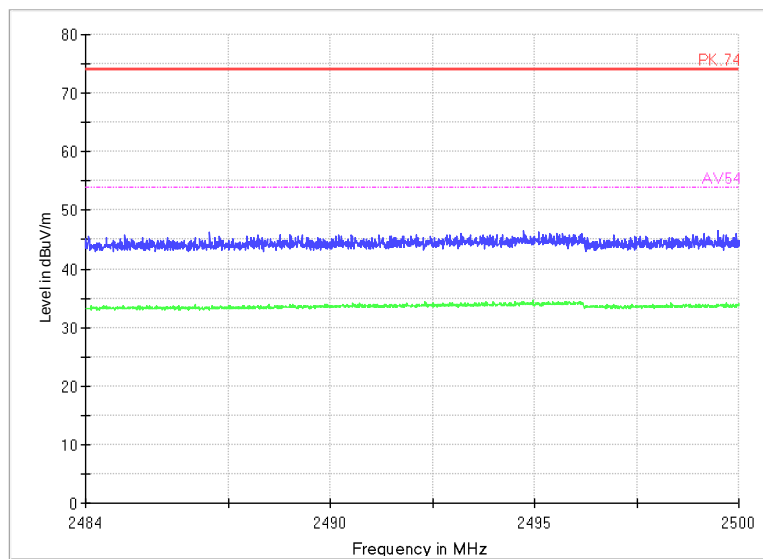


Radiated Emission Band Edge

Carrier frequency (MHz):2410

Test Mode: GFSK

Polarization : H



Radiated Emission Band Edge

Carrier frequency (MHz):2475

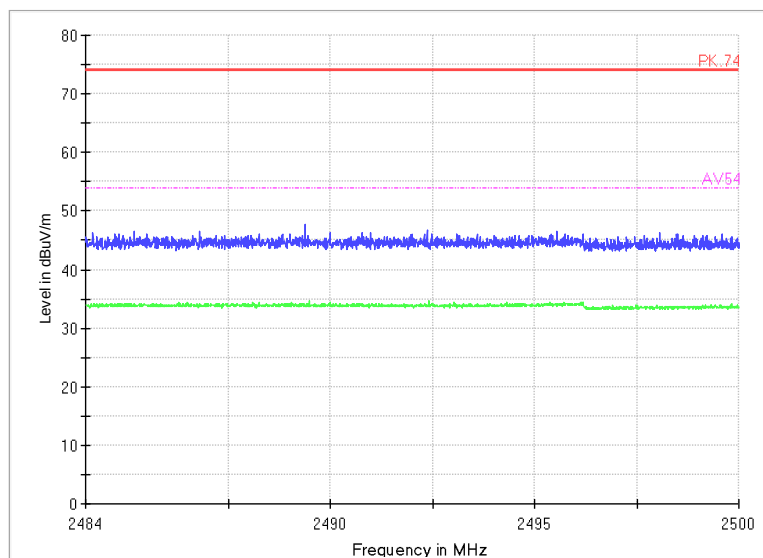
Test Mode: GFSK

Polarization : V



BUREAU
VERITAS

Test Report No.: PSU-NQN2502190114RF01



Radiated Emission Band Edge

Carrier frequency (MHz):2475

Test Mode: GFSK

Polarization : H



Sample Calculations

After comparison, the worst case attitude is EUT lay down.

Determining Spurious Emissions Levels

A “reference path loss” is established and the A_{Rpl} is the attenuation of “reference path loss”, and including the gain of receive antenna, the gain of the preamplifier, the cable loss.

The measurement results are obtained as described below:

$$\text{Result} = P_{\text{mea}} + A_{Rpl}$$

Sample calculation: $(19.95 \text{ dB}\mu\text{V/m}) = (39.65 \text{ dB}\mu\text{V}) + (-19.7 \text{ dB/m})$, the corresponding frequency is 36.014 MHz.

For GFSK

Carrier frequency (MHz): 2410

Frequency (MHz)	Result (dBuV/m)	ARpl (dB)	Pmea (dBuV/m)	Polarity	Limit (dBuV/m)	Margin (dB)
36.014	19.95	-19.7	39.65	Vertical	40	20.05
84.126	32.46	-20.9	53.36	Vertical	40	7.54
142.2775	25.78	-22	47.78	Vertical	43.5	17.72
215.8035	19.66	-18.8	38.46	Vertical	43.5	23.84
478.7705	18.39	-11.5	29.89	Vertical	46	27.61
945.2435	17.87	-3.3	21.17	Vertical	46	28.13

Carrier frequency (MHz): 2445

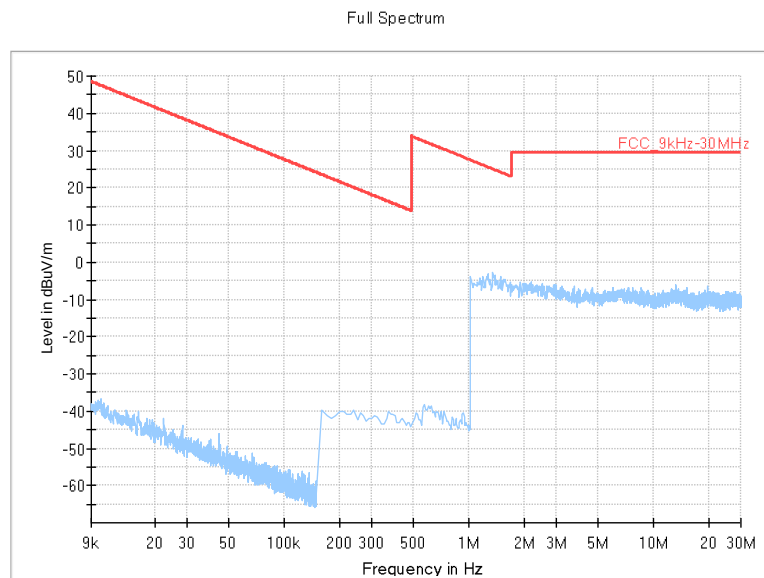
Frequency (MHz)	Result (dBuV/m)	ARpl (dB)	Pmea (dBuV/m)	Polarity	Limit (dBuV/m)	Margin (dB)
48.042	18.04	-18.7	36.74	Vertical	40	21.96
84.126	31.62	-20.9	52.52	Vertical	40	8.38
135.827	26.96	-21.7	48.66	Vertical	43.5	16.54
215.9005	20.45	-18.8	39.25	Vertical	43.5	23.05
480.662	18.64	-11.4	30.04	Vertical	46	27.36
951.306	17.84	-3.2	21.04	Vertical	46	28.16

Carrier frequency (MHz): 2475



BUREAU VERITAS Test Report No.: PSU-NQN2502190114RF01

Frequency (MHz)	Result (dBuV/m)	ARpl (dB)	Pmea (dBuV/m)	Polarity	Limit (dBuV/m)	Margin (dB)
48.042	17.01	-18.7	35.71	Vertical	40	22.99
84.126	31.14	-20.9	52.04	Vertical	40	8.86
167.5945	21.72	-21.4	43.12	Vertical	43.5	21.78
263.285	17.57	-17.3	34.87	Vertical	46	28.43
478.5765	18.26	-11.5	29.76	Vertical	46	27.74
927.25	17.87	-3.4	21.27	Vertical	46	28.13



Frequency Range: 9kHz -30MHz

Detector: QP mode

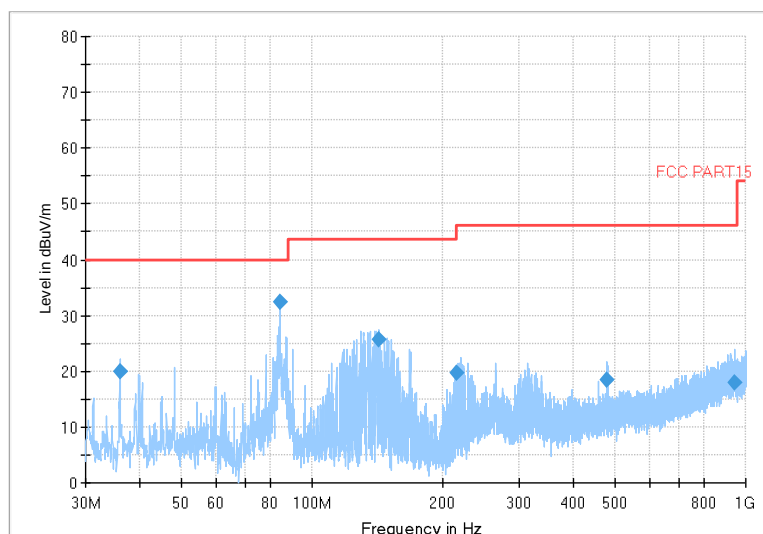
Note : The relevant tests have been performed in order to verify in which mode would have the worst features, the result show above is the worst case.



BUREAU VERITAS Test Report No.: PSU-NQN2502190114RF01

Carrier frequency (MHz): 2410

Full Spectrum

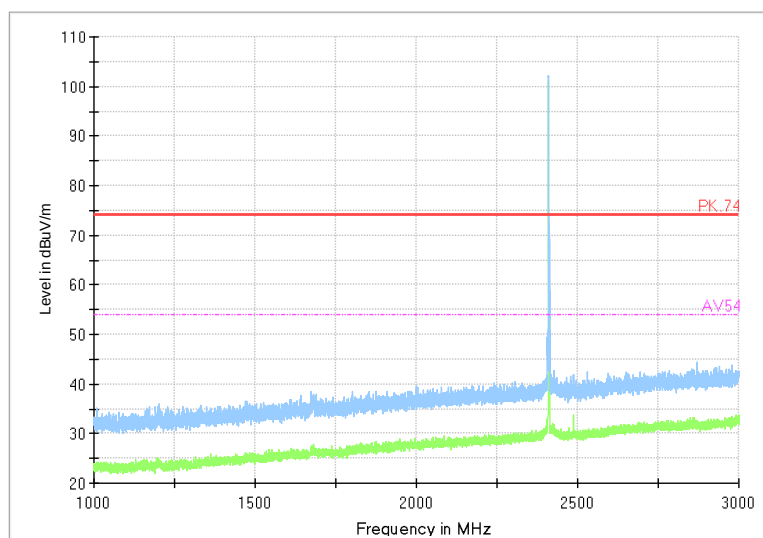


Frequency Range: 30MHz-1GHz

Detector: QP mode

Modulation type: GFSK

Full Spectrum



Frequency Range: 1GHz-3GHz

Detector: Av mode and PK mode

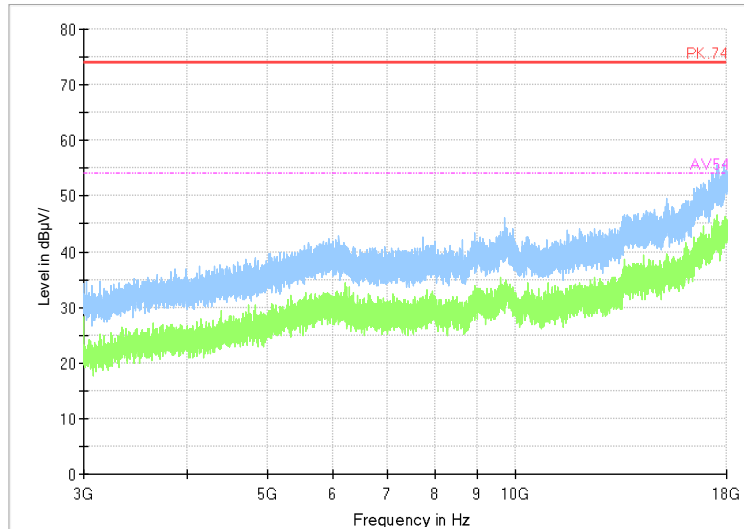
Modulation type: GFSK



BUREAU
VERITAS

Test Report No.: PSU-NQN2502190114RF01

Full Spectrum

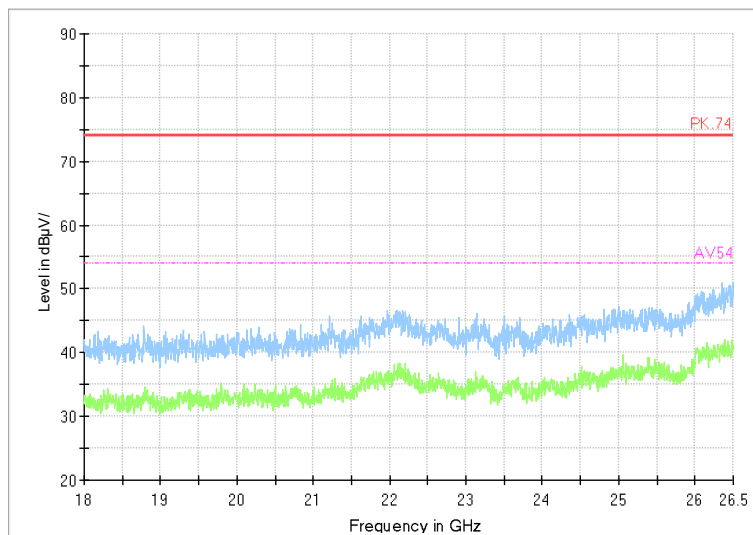


Frequency Range: 3GHz-18GHz

Detector: Av mode and PK mode

Modulation type: GFSK

Full Spectrum



Frequency Range: 18GHz-26GHz

Detector: Av mode and PK mode

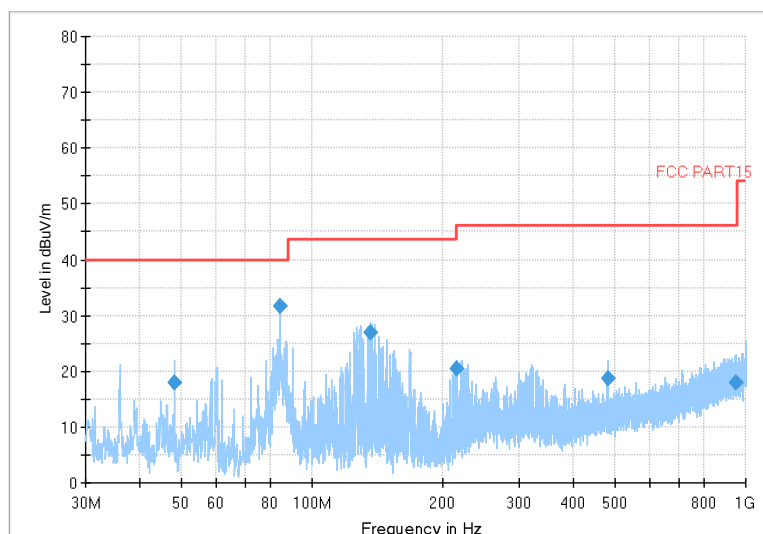
Modulation type: GFSK



BUREAU VERITAS Test Report No.: PSU-NQN2502190114RF01

Carrier frequency (MHz):2445

Full Spectrum

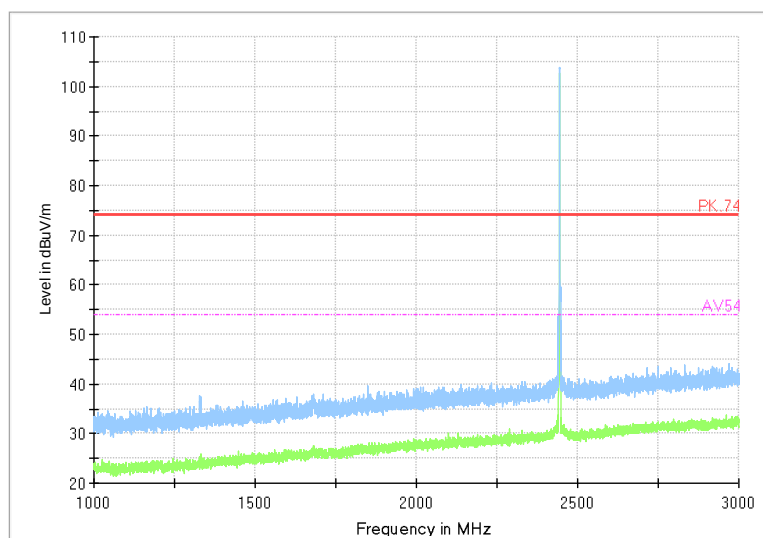


Frequency Range: 30MHz-1GHz

Detector:QP mode

Modulation type: GFSK

Full Spectrum



Frequency Range: 1GHz-3GHz

Detector: Av mode and PK mode

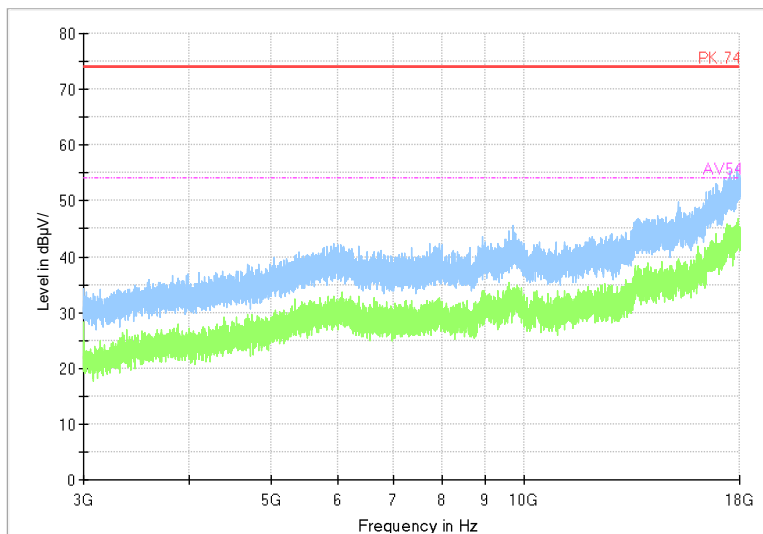
Modulation type: GFSK



BUREAU
VERITAS

Test Report No.: PSU-NQN2502190114RF01

Full Spectrum

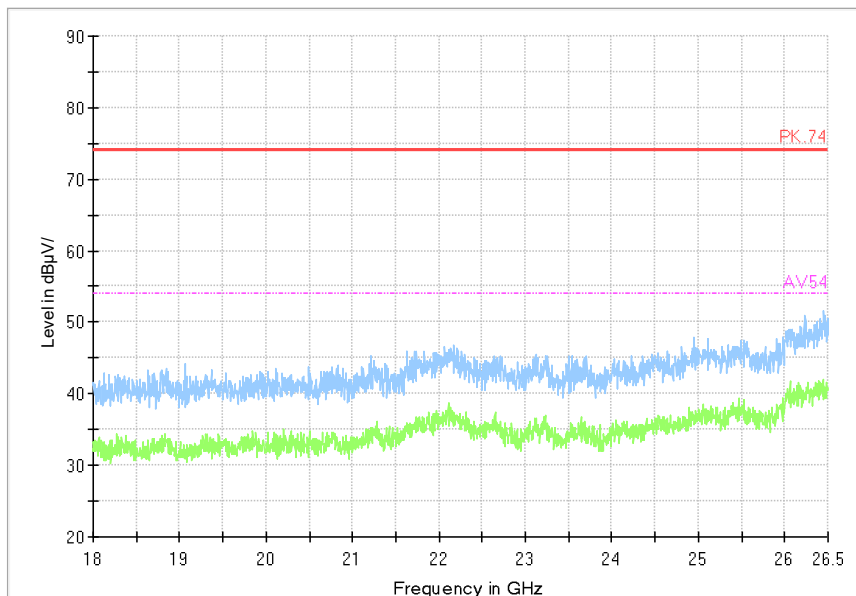


Frequency Range: 3GHz-18GHz

Detector: Av mode and PK mode

Modulation type: GFSK

Full Spectrum



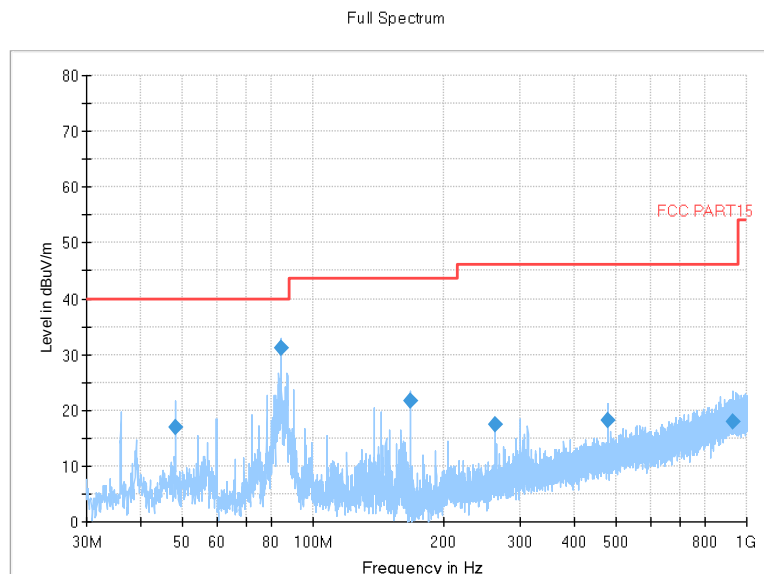
Frequency Range: 18GHz-26GHz

Detector: Av mode and PK mode

Modulation type: GFSK



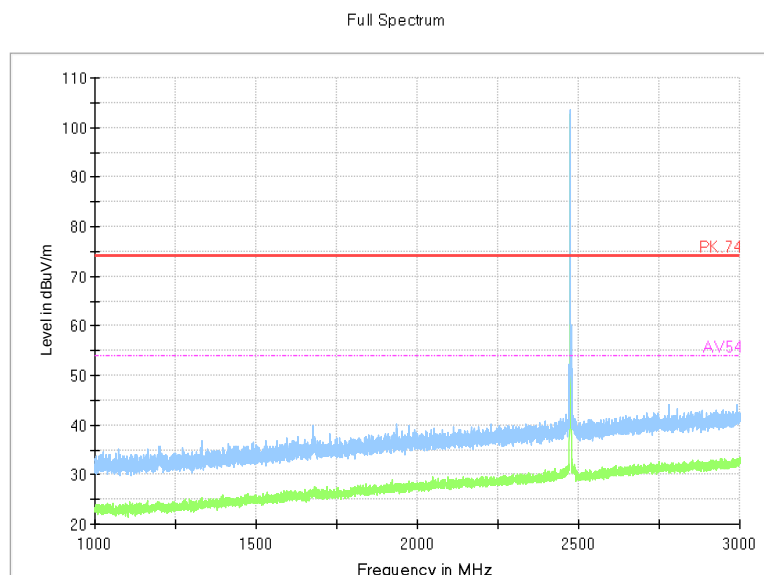
Carrier frequency (MHz):2475



Frequency Range: 30MHz-1GHz

Detector: QP mode

Modulation type: GFSK



Frequency Range: 1GHz-3GHz

Detector: Av mode and PK mode

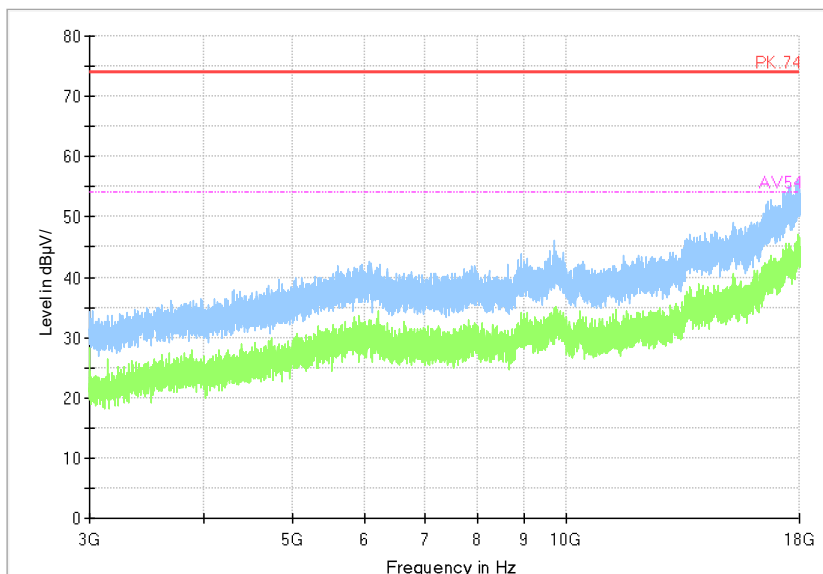
Modulation type: GFSK



BUREAU
VERITAS

Test Report No.: PSU-NQN2502190114RF01

Full Spectrum

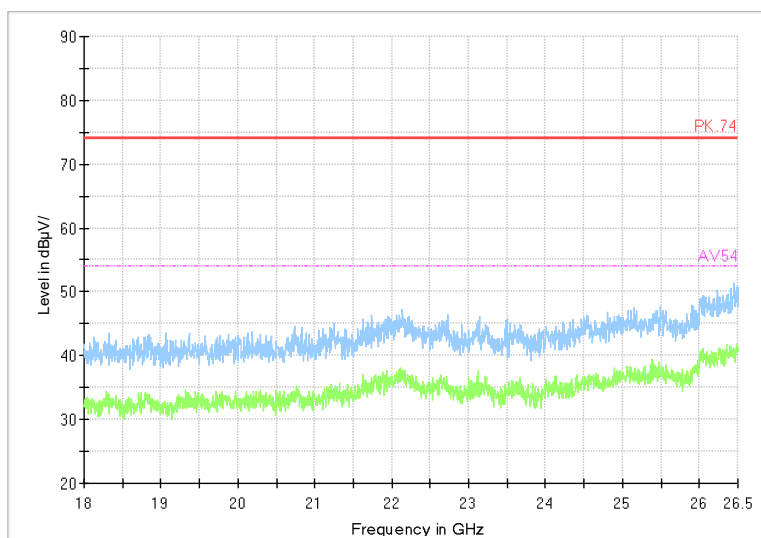


Frequency Range: 3GHz-18GHz

Detector: Av mode and PK mode

Modulation type: GFSK

Full Spectrum



Frequency Range: 18GHz-26GHz

Detector: Av mode and PK mode

Modulation type: GFSK



3.3 6 dB BANDWIDTH MEASUREMENT

3.3.1 LIMITS OF 6dB BANDWIDTH MEASUREMENT

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

3.3.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	R&S	ESW 44	101973	Mar.28,24	Mar.27,26
Open Switch and Control Unit	R&S	OSP-B157W8	100836	N/A	N/A
Vector Signal Generator	R&S	SMBV100B	102176	Mar.29,24	Mar.28,26
Signal Generator	R&S	SMB100A03	182185	Mar.29,24	Mar.28,26
WIDEBANDRADIO COMMUNICATION TESTER	R&S	CMW500	169399	Jun.19,24	Jun.18,26
Hygrothermograph	DELI	20210528	SZ015	Sep.06,23	Sep.05,25
PC	LENOVO	E14	HRSW0024	N/A	N/A
CABLE	R&S	J12J103539-00-1	SEP-03-20-069	Apr.27,24	Apr.26,25
CABLE	R&S	J12J103539-00-1	SEP-03-20-070	Apr.27,24	Apr.26,25
Test Software	EMC32	EMC32	N/A	N/A	N/A
Temperature Chamber	votsch	VT4002	58566078100050	May.30,24	May.29,26
Power Meter	R&S	NRX	102380	Mar.28,24	Mar.27,26
Power Meter probe	R&S	NRP6A	102942	Mar.28,24	Mar.27,26

NOTE:

1. The calibration interval of the above test instruments is 12/ 24 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
2. The test was performed in RF Oven room.



3.3.3 TEST PROCEDURE

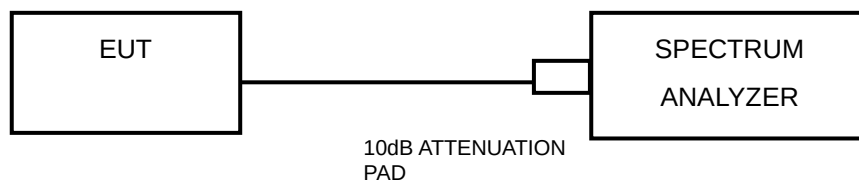
1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.



3.3.4 DEVIATION FROM TEST STANDARD

No deviation.

3.3.5 TEST SETUP



3.3.6 EUT OPERATING CONDITIONS

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.



BUREAU VERITAS Test Report No.: PSU-NQN2502190114RF01

3.3.7 TEST RESULTS

Please Refer to Appendix Of this test report.

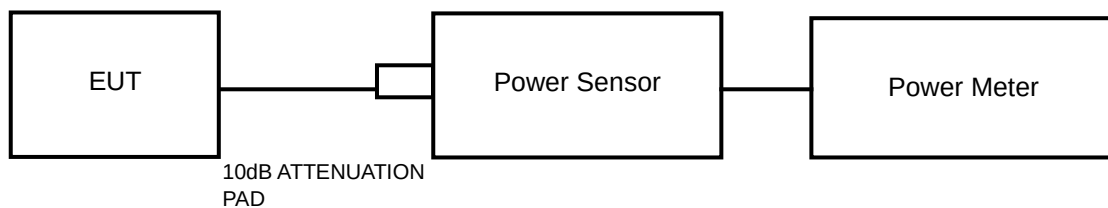


3.4 CONDUCTED OUTPUT POWER

3.4.1 LIMITS OF CONDUCTED OUTPUT POWER MEASUREMENT

For systems using digital modulation in the 2400–2483.5 MHz band: 1 Watt (30dBm)

3.4.2 TEST SETUP



3.4.3 TEST INSTRUMENTS

Refer to section 3.3.2 to get information of above instrument.

3.4.4 TEST PROCEDURES

A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.

3.4.5 DEVIATION FROM TEST STANDARD

No deviation.

3.4.6 EUT OPERATING CONDITIONS

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.



3.4.7 TEST RESULTS

3.4.7.1 MAXIMUM PEAK OUTPUT POWER

Please Refer to Appendix Of this test report.



Test Report No.: PSU-NQN2502190114RF01

3.4.7.2 AVERAGE OUTPUT POWER (FOR REFERENCE)

The average power sensor was used on the output port of the EUT. A power meter was used to read the response of the power sensor. Record the power level.

Please Refer to Appendix Of this test report.



3.5 POWER SPECTRAL DENSITY MEASUREMENT

3.5.1 LIMITS OF POWER SPECTRAL DENSITY MEASUREMENT

The Maximum of Power Spectral Density Measurement is 8dBm/3KHz.

3.5.2 TEST SETUP



3.5.3 TEST INSTRUMENTS

Refer to section 3.3.2 to get information of above instrument.

3.5.4 TEST PROCEDURE

1. Set the span to 1.5 times the DTS bandwidth
2. Set the RBW = 3 kHz, VBW $\geq 3 \times$ RBW, Detector = peak.
3. Sweep time = auto couple, Trace mode = max hold, allow trace to fully stabilize.
4. Use the peak marker function to determine the maximum amplitude level.

3.5.5 DEVIATION FROM TEST STANDARD

No deviation.

3.5.6 EUT OPERATING CONDITION

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.



3.5.7 TEST RESULTS

Please Refer to Appendix Of this test report.

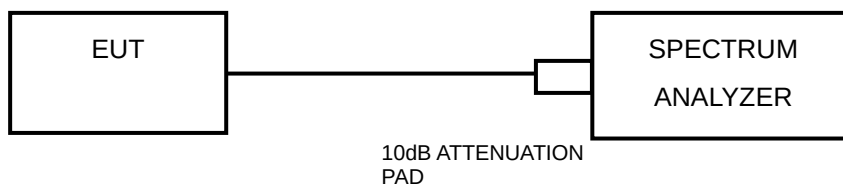


3.6 OUT OF BAND EMISSION MEASUREMENT

3.6.1 LIMITS OF OUT OF BAND EMISSION MEASUREMENT

Below –20dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

3.6.2 TEST SETUP



3.6.3 TEST INSTRUMENTS

Refer to section 3.3.2 to get information of above instrument.

3.6.4 TEST PROCEDURE

MEASUREMENT PROCEDURE REF

1. Set the RBW = 100 kHz.
2. Set the VBW $\geq$ 300 kHz.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.



MEASUREMENT PROCEDURE OOB

1. Set RBW = 100 kHz.
2. Set VBW $\geq$ 300 kHz.
3. Set span to encompass the spectrum to be examined
4. Detector = peak.
5. Trace Mode = max hold.
6. Sweep = auto couple.

3.6.5 DEVIATION FROM TEST STANDARD

No deviation.

3.6.6 EUT OPERATING CONDITION

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

3.6.7 TEST RESULTS

The spectrum plots are attached on the following images. D1 line indicates the highest level. D2 line indicates the 20dB offset below D1. It shows compliance to the requirement.

Please Refer to Appendix Of this test report.



3.7 ANTENNA REQUIREMENTS

3.7.1 STANDARD APPLICABLE

If transmitting antenna directional gain is greater than 6 dBi, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.7.2 ANTENNA CONNECTED CONSTRUCTION

An embedded-in antenna design is used.

3.7.3 ANTENNA GAIN

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit and PSD limit.

4 PHOTOGRAPHS OF THE TEST CONFIGURATION

Please refer to the attached file (Test Setup Photo).

5 MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

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



BUREAU
VERITAS

Test Report No.: PSU-NQN2502190114RF01

6 APPENDIX

DTS

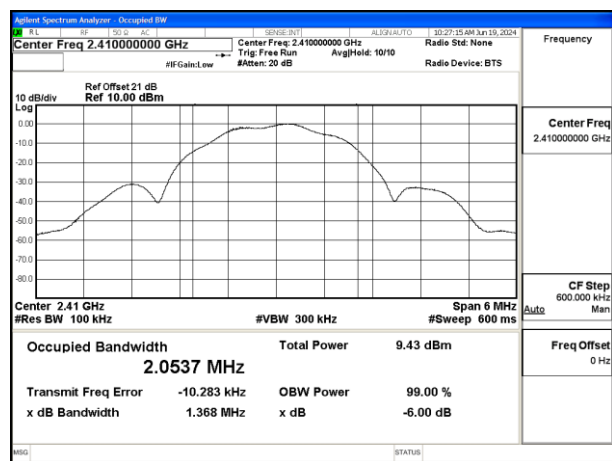
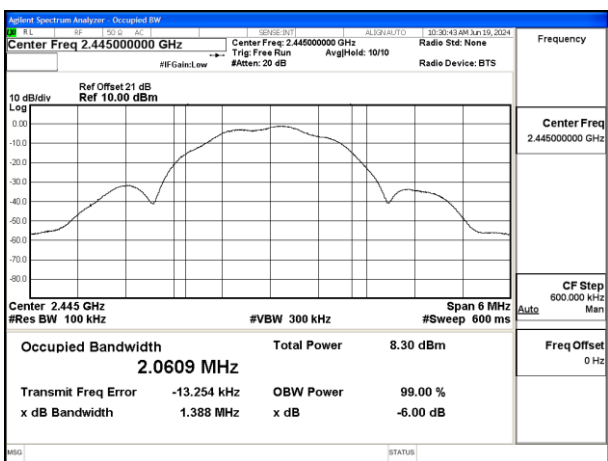
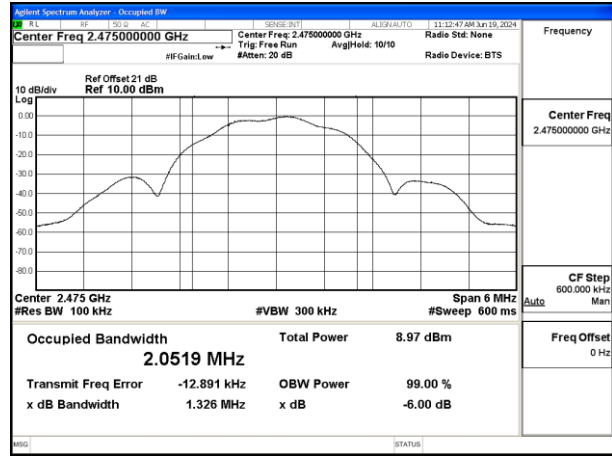
DTS BANDWIDTH

TEST RESULT

Test Mode	Carrier frequency (MHz)	6dB Bandwidth(KHz)
GFSK	2410	1368.0
GFSK	2445	1387.6
GFSK	2475	1325.7

TEST GRAPHS

Test Mode: GFSK (DTS)

	
Test Mode:GFSK 2410MHz	Test Mode:GFSK 2445MHz
	
Test Mode:GFSK 2475MHz	



BUREAU
VERITAS

Test Report No.: PSU-NQN2502190114RF01

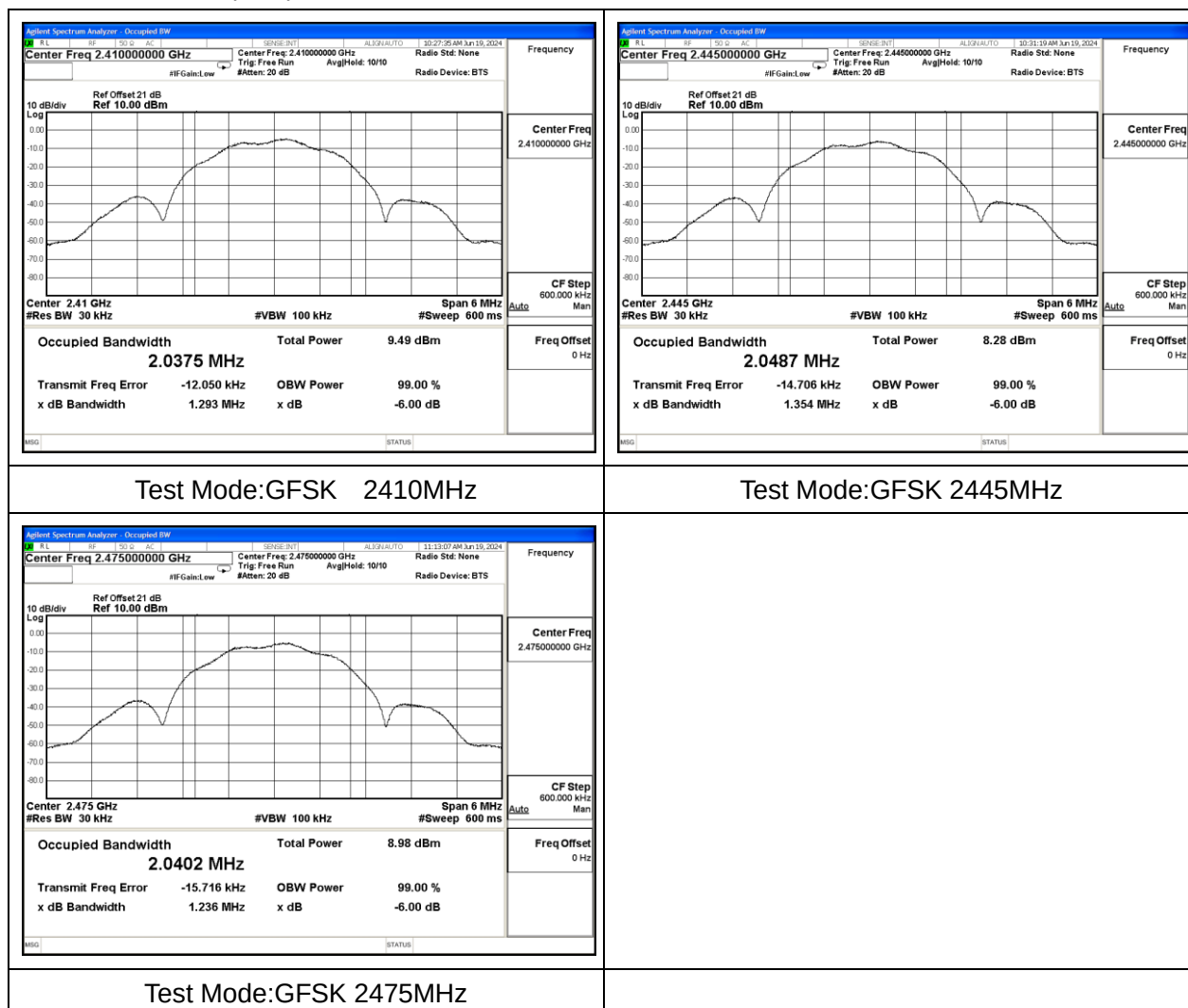
OCCUPIED CHANNEL BANDWIDTH

TEST RESULT

Test Mode	Carrier frequency (MHz)	99% Bandwidth(kHz)
GFSK	2410	2037.5
GFSK	2445	2048.7
GFSK	2475	2040.2

TEST GRAPHS

Test Mode: GFSK (DTS)





BUREAU VERITAS Test Report No.: PSU-NQN2502190114RF01

MAXIMUM CONDUCTED OUTPUT POWER

TEST RESULT

NOTE: EIRP = Peak Power + Gain

Conducted Power

Modulation type	Conducted Peak Power(dBm)		
	2410MHz	2445MHz	2475MHz
GFSK	9.53	8.37	9.11

Modulation type	Conducted Average Power(dBm)		
	2410MHz	2445MHz	2475MHz
GFSK	9.34	8.24	8.95

EIRP

Modulation type	Peak EIRP(dBm)		
	2410MHz	2445MHz	2475MHz
GFSK	14.13	12.97	13.71

Modulation type	Average EIRP(dBm)		
	2410MHz	2445MHz	2475MHz
GFSK	13.94	12.84	13.55



BUREAU
VERITAS

Test Report No.: PSU-NQN2502190114RF01

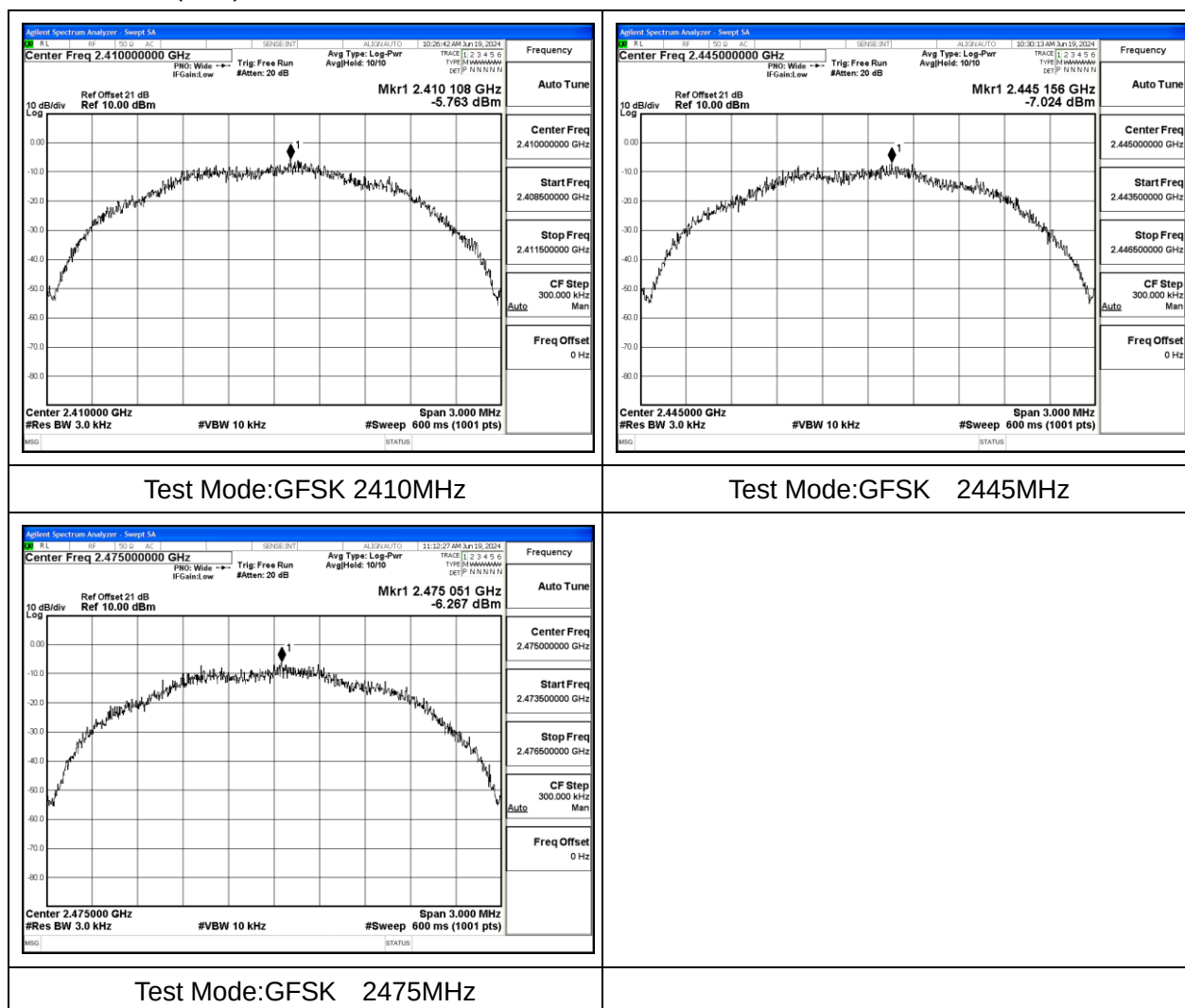
MAXIMUM POWER SPECTRAL DENSITY

TEST RESULT

Test Mode	Carrier frequency (MHz)	Channel No.	Power Density (dBm/3kHz)
GFSK	2410	1	-5.8
GFSK	2445	7	-7.0
GFSK	2475	13	-6.3

TEST GRAPHS

Mode: GFSK (DTS)





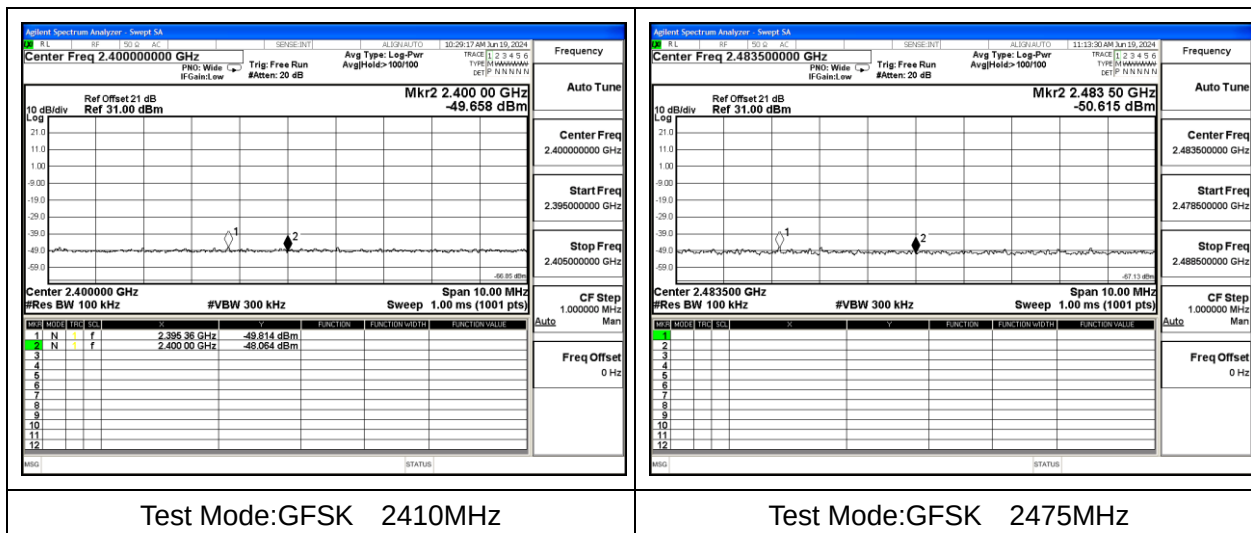
BUREAU
VERITAS

Test Report No.: PSU-NQN2502190114RF01

BAND EDGE MEASUREMENTS

TEST RESULT

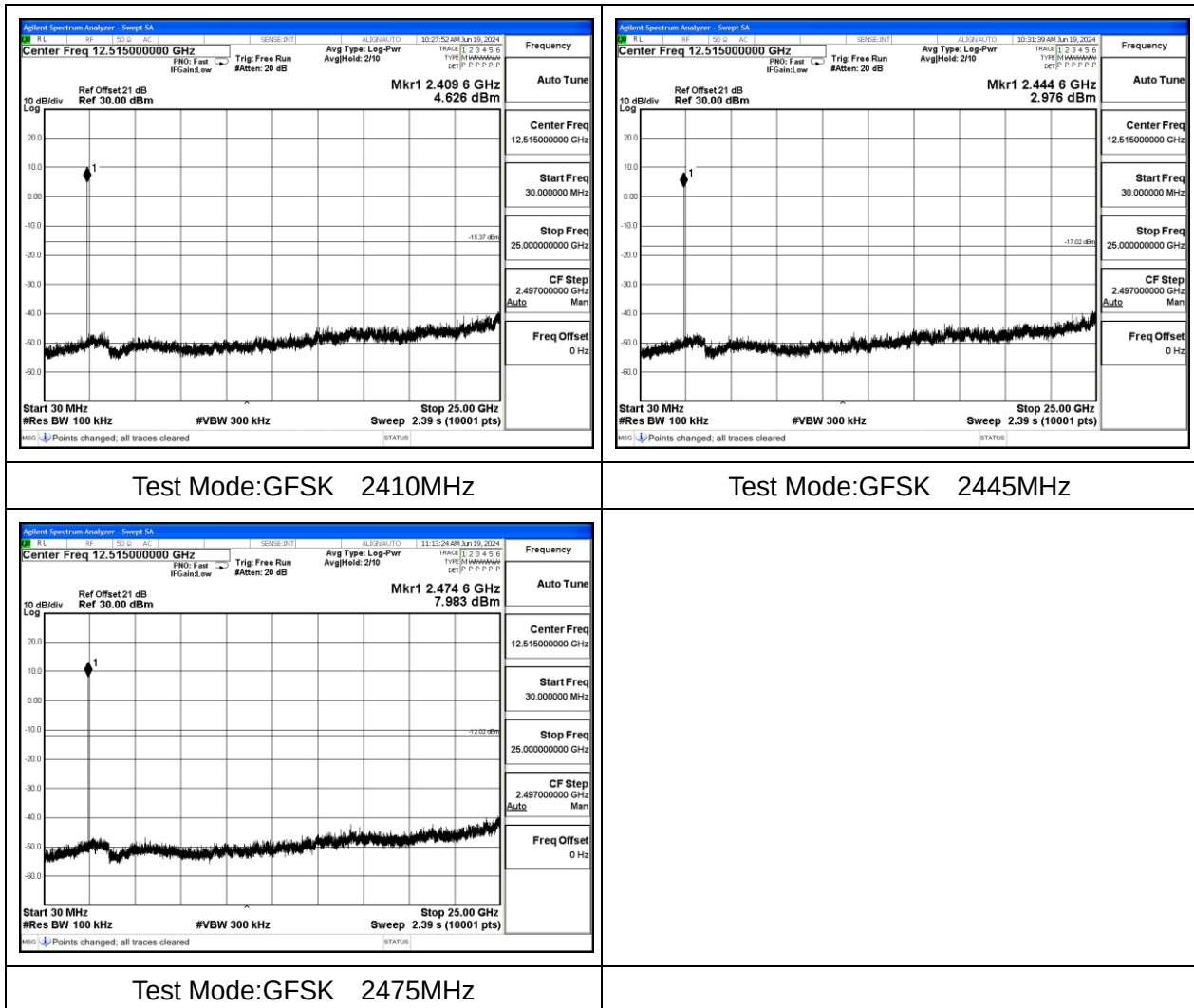
Test Mode: GFSK (DTS)





CONDUCTED SPURIOUS EMISSION TEST RESULT

est Mode: GFSK (DTS)





DUTY CYCLE

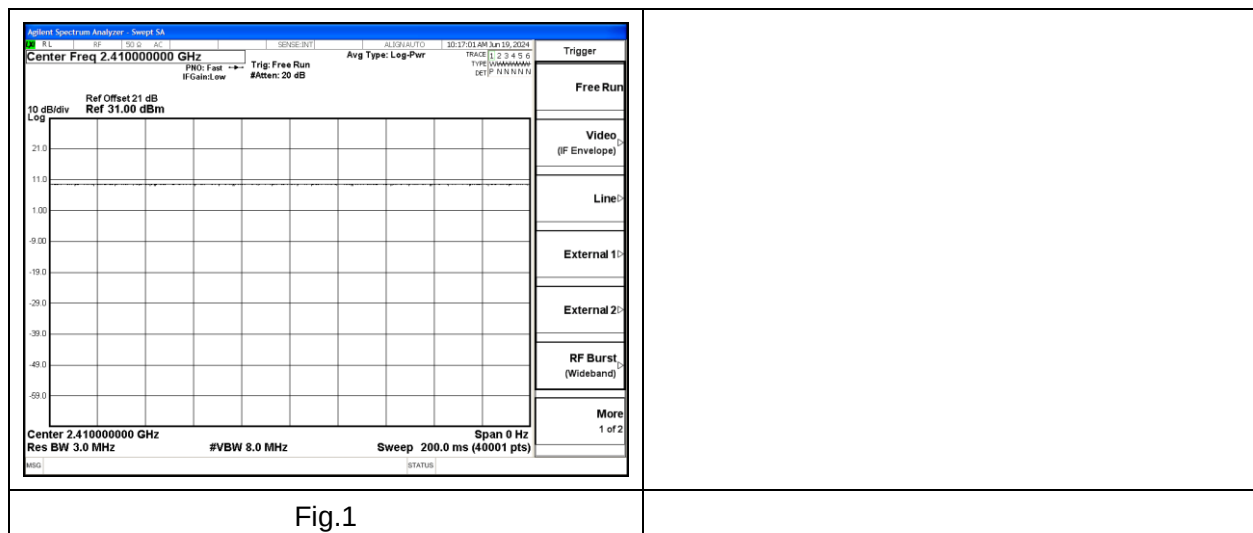
TEST RESULT

Test Mode	Frequency (MHz)	Plot	Duty Cycle	Correction Factor(dB)	Antenna Gain(dBi)
GFSK	2410	Fig.1	100.00%	0.00	4.60

Note: Correction Factor= $10 \cdot \log(1/\text{Duty Cycle})$

TEST GRAPHS

Test Mode: GFSK (DTS)



---END---