





# **FCC Test Report**

FCC ID : SQG-CL4490

Equipment : ConnexLink 900MHz 1W RS232

ConnexLink 900MHz 1W RS485

ConnexLink 900MHz 1W RS232/422/485 Refer to section 1.1.1 for more details

Model No. : CL4490-1000-232 ; CL4790-1000-232

CL4490-1000-485; CL4790-1000-485

CL4490-1000-PRO

Refer to section 1.1.1 for more details

Brand Name : Laird Connectivity

Applicant : Laird Connectivity LLC

Address : W66N220 Commerce Court, Cedarburg, WI

53012 United States Of America

Standard : 47 CFR FCC Part 15.247

Received Date : Mar. 29, 2022

Tested Date : Mar. 29 ~ Apr. 25, 2022

We, International Certification Corporation, would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. The test results contained in this report refer exclusively to the product. It shall not be reproduced except in full without the written approval of our laboratory.

Reviewed by: Approved by:

Along Chen / Assistant Manager Gary Chang / Man

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- **Appendix F. Channel Separation**
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# **Release Record**

Report No.	Version	Description	Issued Date
FR232903	Rev. 01	Initial issue	Jul. 29, 2022

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# **Summary of Test Results**

FCC Rules	Test Items	Measured	Result
15.207	AC Power Line Conducted Emission	[dBuV]: 0.204MHz 52.26 (Margin -11.19dB) - QP	Pass
15.247(d) 15.209	TX Unwanted Emissions	[dBuV/m at 3m]: 73.89MHz 35.77 (Margin -4.23dB) - PK	Pass
15.247(d)	Band Edge	Meet the requirement of limit	Pass
15.247(b)(2)(3)	Conducted Output Power	Power [dBm]: 28.12	Pass
15.247(a)(1)(i)	Number of Hopping Channels	Meet the requirement of limit	Pass
15.247(a)(1)	Hopping Channel Separation	Meet the requirement of limit	Pass
15.247(a)(1)(i)	20 dB and Occupied Bandwidth	Meet the requirement of limit	Pass
15.247(f) Dwell Time		Meet the requirement of limit	Pass
15.203	Antenna Requirement	Meet the requirement of limit	Pass

#### **Declaration of Conformity:**

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

#### **Comments and Explanations:**

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

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# 1 General Description

#### 1.1 Information

#### 1.1.1 Product Details

The following models are provided to this EUT.

Model Name	Product Name	Description
CL4490-1000-232	ConnexLink 900MHz 1W RS232	DB-9 Male (RS232)
CL4790-1000-232	ConnexLink 900MHz 1W RS232	DB-9 Male (RS232) / SW different
CL4490-1000-485	ConnexLink 900MHz 1W RS485	Terminal Block (RS485)
CL4790-1000-485	ConnexLink 900MHz 1W RS485	Terminal Block (RS485) / SW different
CL4490-1000-PRO	ConnexLink 900MHz 1W RS232/422/485	DB-9 Female/DIP Switch

# 1.1.2 Specification of the Equipment under Test (EUT)

RF General Information					
Frequency Range (MHz)	Ch. Freq. (MHz)	Channel List	Data Rate	Channel Bandwidth (kHz)	
902 ~ 928	902 ~ 928	50 channels	76.8kbps	145	

Note 1: RF output power specifies that Maximum Peak Conducted Output Power.

Note 2: The device uses FSK modulation.

Note 3: The device supports FHSS mode.

#### 1.1.3 Antenna Details

Ant. No.	Model	Туре	Connector	Gain (dBi)
1	S467AH-915S	dipole	R-SMA	2.0
2	S331AH-915	dipole	R-SMA	2.0

Note: Antenna 1 with worst gain was chosen for final test

#### 1.1.4 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	12Vdc from adapter
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## 1.1.5 Accessories

	Accessories				
No.	Equipment	Description			
1	AC adapter	Brand: ITE Model: MU12AY120100-A1 I/P: 100-240Vac, 50/60Hz, 0.3A O/P: 12Vdc, 1A Power Line: 1.48m non-shielded without core			
2	RS232 (for CL4x90-1000-PRO)	1.85m non-shielded without core			
3	RS232 (for CL4x90-1000-232)	1.85m non-shielded without core			

## 1.1.6 Channel List

Channel	Frequency (MHz)						
0	902.213	13	909.06	26	915.903	39	922.751
1	902.74	14	909.585	27	916.431	40	923.278
2	903.267	15	910.111	28	916.958	41	923.805
3	903.795	16	910.638	29	917.486	42	924.333
4	904.321	17	911.167	30	918.012	43	924.858
5	904.846	18	911.692	31	918.538	44	925.385
6	905.375	19	912.217	32	919.063	45	925.911
7	905.9	20	912.743	33	919.591	46	926.439
8	906.428	21	913.27	34	920.116	47	926.965
9	906.952	22	913.7	35	920.643	48	927.492
10	907.478	23	914.325	36	921.172	49	927.256
11	908.01	24	914.852	37	921.697		
12	908.532	25	915.378	38	922.223		

# 1.1.7 Test Tool and Duty Cycle

Test Tool	Laird Technologies Config, Version: V6.07			
Mode	Duty Cycle (%) Duty Factor (dB)			
FSK	100.00%	0.00		

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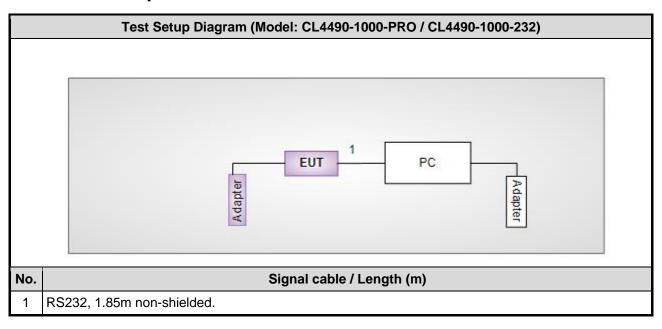
#### 1.1.8 Power Index of Test Tool

Test Frequency (MHz)	Power Index
902.213	default
915.378	default
927.492	default

# 1.2 Local Support Equipment List

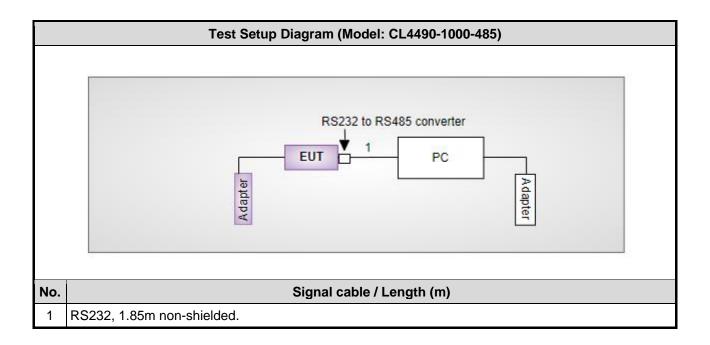
Support Equipment List						
No.	No. Equipment Brand Model FCC ID Remarks					
1	PC	MSI	Cubi B164		Provided by applicant.	
2	RS232 to RS485 converter	UTEK	UT-2201		Provided by applicant.	
3	PC adapter	AcBel	ADC027		Provided by applicant.	

# 1.3 Test Setup Chart



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# 1.4 The Equipment List

Test Item	Conducted Emission								
Test Site	Conduction room 1 / (CO01-WS)								
Tested Date	Apr. 19, 2022	Apr. 19, 2022							
Instrument	Brand	Brand Model No. Serial No. Calibration Date Calibration Until							
Receiver	R&S	ESR3	101658	Feb. 16, 2022	Feb. 15, 2023				
LISN	R&S	ENV216	101295	Jan. 12, 2022	Jan. 11, 2023				
LISN (Support Unit)	SCHWARZBECK	NSLK 8127	8127667	Jan .07, 2022	Jan .06, 2023				
RF Cable-CON	Woken	CFD200-NL	CFD200-NL-001	Oct. 19, 2021	Oct. 18, 2022				
50 ohm terminal (Support Unit)	NA	May. 25, 2021	May. 24, 2022						
Measurement Software									
Note: Calibration Inter	val of instruments liste	d above is one year.							

Test Item	Radiated Emission						
Test Site	966 chamber1 / (03Cl	966 chamber1 / (03CH01-WS)					
Tested Date	Apr. 11 ~ Apr. 13, 2022						
Instrument	Brand	Model No.	Serial No.	Calibration Date	Calibration Until		
Receiver	R&S	ESR3	101657	Mar. 15, 2022	Mar. 14, 2023		
Spectrum Analyzer	R&S	FSV40	101063	Apr. 19, 2021	Apr. 18, 2022		
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 08, 2021	Nov. 07, 2022		
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-522	Jun. 30, 2021	Jun. 29, 2022		
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1096	Dec. 03, 2021	Dec. 02, 2022		
Preamplifier	EMC	EMC02325	980225	Jun. 29, 2021	Jun. 28, 2022		
Preamplifier	Agilent	83017A	MY39501308	Sep. 28, 2021	Sep. 27, 2022		
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Oct. 05, 2021	Oct. 04, 2022		
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-001	Oct. 05, 2021	Oct. 04, 2022		
LF cable 11M	EMC	EMCCFD400-NW-N W-11000	200801	Oct. 05, 2021	Oct. 04, 2022		
LF cable 1M	EMC	EMCCFD400-NM-N M-1000	160502	Oct. 05, 2021	Oct. 04, 2022		
RF Cable	EMC	EMC104-35M-35M- 8000	210920	Oct. 05, 2021	Oct. 04, 2022		
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16019/4	Oct. 05, 2021	Oct. 04, 2022		
Measurement Software	AUDIX	e3	6.120210g	NA	NA		
Note: Calibration Inter	rval of instruments liste	d above is one year.					

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Test Item	RF Conducted							
Test Site	(TH01-WS)							
Tested Date	Mar. 29 ~ Apr. 25, 202	22						
Instrument	Brand	Brand Model No. Serial No. Calibration Date Calibration Until						
Spectrum Analyzer	R&S	FSV40	101498	Nov. 29, 2021	Nov. 28, 2022			
Power Meter	Anritsu	ML2495A	1241002	Nov. 07, 2021	Nov. 06, 2022			
Power Sensor	Anritsu	MA2411B	1207366	Nov. 07, 2021	Nov. 06, 2022			
Measurement Software     Sporton     SENSE-15247_FS     V5.10.7.11     NA     NA								
Note: Calibration Inte	rval of instruments liste	d above is one year.		•				

# 1.5 Test Standards

47 CFR FCC Part 15.247 ANSI C63.10-2013

#### 1.6 Reference Guidance

FCC KDB 558074 D01 15.247 Meas Guidance v05r02

### 1.7 Deviation from Test Standard and Measurement Procedure

None

# 1.8 Measurement Uncertainty

The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)).

Measurement Uncertainty				
Parameters	Uncertainty			
Bandwidth	±34.130 Hz			
Conducted power	±0.808 dB			
Power density	±0.583 dB			
TX Unwanted Emission ≤ 1GHz	±3.41 dB			
TX Unwanted Emission > 1GHz	±4.59 dB			

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# 2 Test Configuration

# 2.1 Testing Facility

Test Laboratory International Certification Corporation				
Test Site	CO01-WS, 03CH01-WS, TH01-WS			
Address of Test Site	No.3-1, Lane 6, Wen San 3rd St., Kwei Shan Dist., Tao Yuan City 33381, Taiwan (R.O.C.)			

FCC Designation No.: TW2732FCC site registration No.: 181692

➤ ISED#: 10807A

➤ CAB identifier: TW2732

#### 2.2 The Worst Test Modes and Channel Details

Test item	Modulation Mode	Test Frequency (MHz)	Radiated / Conducted Measurement	Test Configuration	Mode
AC Power Line Conducted Emission	FSK	902.213 / 915.378 / 927.492	Conducted	1, 2, 3	Тх
TX Unwanted Emissions ≤ 1GHz	FSK	902.213 / 915.378 / 927.492	Radiated	1, 2, 3	Тх
TX Unwanted Emissions >1GHz	FSK	902.213 / 915.378 / 927.492	Radiated	1, 3	Tx
Conducted Output Power Hopping Channel Separation 20dB and Occupied bandwidth	FSK	902.213 / 915.378 / 927.492	Conducted	1, 3	Tx
Number of Hopping Channels	FSK	902.213	Conducted	1, 3	Tx
Dwell Time	FSK	902.213	Conducted	1, 3, 4	Tx
Band Edge	FSK	902.213 / 927.492	Conducted	1, 3	Tx

#### NOTE:

1. The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement – X, Y, and Z-plane. The **Z-plane** result was found as the worst case and was shown in this report.

2. Test configurations are listed as below:

Configuration 1: Model: CL4490-1000-232
 Configuration 2: Model: CL4490-1000-485
 Configuration 3: Model: CL4490-1000-PRO
 Configuration 4: Model: CL4790-1000-232

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#### 3 Transmitter Test Results

## 3.1 TX Unwanted Emissions into Restricted Frequency Bands

#### 3.1.1 Limit of TX Unwanted Emissions into Restricted Frequency Bands

Restricted Band Emissions Limit					
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)		
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300		
0.490~1.705	24000/F(kHz)	33.8 - 23	30		
1.705~30.0	30	29	30		
30~88	100	40	3		
88~216	150	43.5	3		
216~960	200	46	3		
Above 960	500	54	3		

#### Note 1:

Qusai-Peak value is measured for frequency below 1GHz except for 9–90 kHz, 110–490 kHz frequency band. Peak and average value are measured for frequency above 1GHz. The limit on average radio frequency emission is as above table. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit **Note 2**:

Measurements may be performed at a distance other than what is specified provided. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor as below, Frequency at or above 30 MHz: 20 dB/decade Frequency below 30 MHz: 40 dB/decade.

#### 3.1.2 Test Procedures

- Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission frequency. The EUT is placed at test table. For emissions testing at or below 1 GHz, the table height is 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height is 1.5 m
- 2. Measurement is made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna is varied in height (1m ~ 4m) above the reference ground plane to obtain the maximum signal strength. Distance between EUT and antenna is 3 m.
- 3. This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

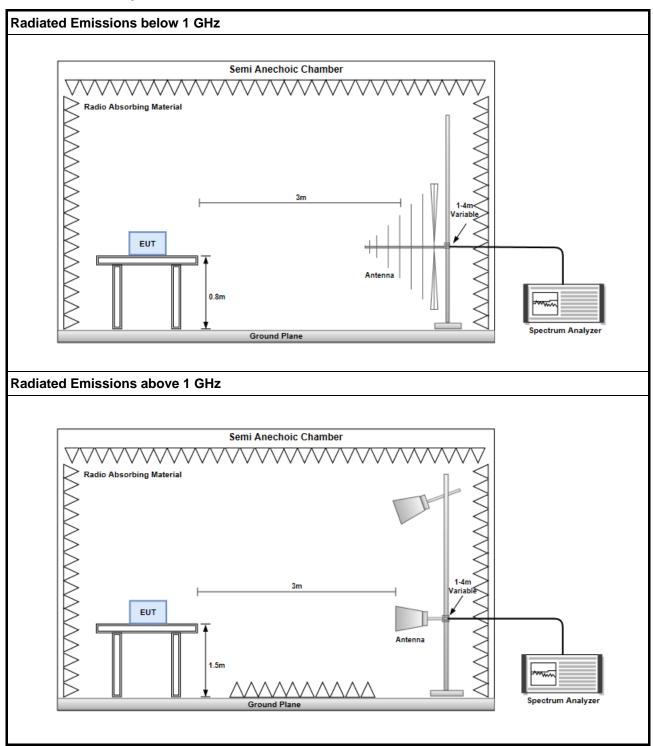
#### Note:

- 1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
- 2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
- 3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above 1GHz.

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## 3.1.3 Test Setup



#### 3.1.4 Test Results

Refer to Appendix A.

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# 3.2 TX Unwanted Emissions into Non-Restricted Frequency Bands

#### 3.2.1 Limit of TX Unwanted Emissions into Non-Restricted Frequency Bands

The peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz.

#### 3.2.2 Test Procedures

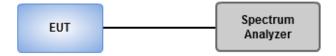
#### **Reference Level Measurement**

- 1. Set the RBW = 100 kHz, VBW = 300 kHz, Detector = peak.
- Set Sweep time = auto couple, Trace mode = max hold.
- 3. Allow trace to fully stabilize.
- 4. Use the peak marker function to determine the maximum amplitude level.

#### **Unwanted Emissions Level Measurement**

- 1. Set RBW = 100 kHz, VBW = 300 kHz, Detector = peak.
- 2. Trace Mode = max hold, Sweep = auto couple.
- 3. Allow the trace to stabilize.
- Use peak marker function to determine maximum amplitude of all unwanted emissions within any 100 kHz bandwidth.

#### 3.2.3 Test Setup



#### 3.2.4 Test Results

Ambient Condition	23~24°C / 65~68%	Tested By	Aska Huang
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Refer to Appendix B.

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# 3.3 Conducted Output Power

#### 3.3.1 Limit of Conducted Output Power

1W

#### 3.3.2 Test Procedures

- A wideband power meter is used for power measurement. Bandwidth of power senor and meter is 50MHz
- 2 If duty cycle of test signal is not 100 %, trigger and gating function of power meter will be enabled to capture transmission burst for measuring output power

#### 3.3.3 Test Setup



#### 3.3.4 Test Results

Ambient Condition 23~24°C / 65~68%	Tested By	Aska Huang
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Refer to Appendix C.

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# 3.4 Number of Hopping Frequency

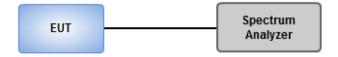
## 3.4.1 Limit of Number of Hopping Frequency

	Number of Hopping Frequencies Limit for Frequency Hopping Systems				
	☑ 902-928 MHz Band:				
	$\boxtimes$	N ≥ 50, 20 dB bandwidth of the hopping channel is less than 250 kHz			
		N ≥ 25, 20 dB bandwidth of the hopping channel is 250 kHz or greater			
	☐ Hybrid mode, No minimum number of hopping channels associated with hybrid system.				
<b>N</b> : N	N: Number of Hopping Frequencies				

#### 3.4.2 Test Procedures

- 1. Set RBW = 100kHz, VBW = 300kHz, Sweep time = Auto, Detector = Peak Trace max hold.
- 2 Allow trace to stabilize.

## 3.4.3 Test Setup



#### 3.4.4 Test Results

Ambient Condition	23~24°C / 65~68%	Tested By	Aska Huang

Refer to Appendix D.

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# 3.5 20dB and Occupied Bandwidth

#### 3.5.1 Test Procedures

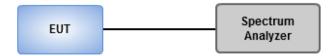
#### 20dB Bandwidth

- 1. Set RBW=3kHz, VBW=10kHz, Sweep time=Auto, Detector=Peak Trace max hold.
- 2 Allow trace to stabilize.
- 3 Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.

#### **Occupied Bandwidth**

- 1. Set RBW=3kHz, VBW=10kHz, Sweep time = Auto, Detector=Peak, Trace max hold
- 2 Allow trace to stabilize
- 3. Use Occupied bandwidth function of spectrum analyzer to measuring 99% occupied bandwidth

#### 3.5.2 Test Setup



#### 3.5.3 Test Results

Ambient Condition 23~24°	C / 65~68% Tested B	Aska Huang	9
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Refer to Appendix E.

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# 3.6 Channel Separation

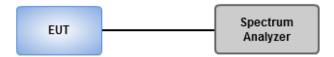
#### 3.6.1 Limit of Channel Separation

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

#### 3.6.2 Test Procedures

- 1. Set RBW=10kHz, VBW=30kHz, Sweep time=Auto, Detector=Peak Trace max hold.
- 2 Allow trace to stabilize.
- 3 Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The EUT shall show compliance with the appropriate regulatory limit

#### 3.6.3 Test Setup



#### 3.6.4 Test Results

	Ambient Condition	23~24°C / 65~68%	Tested By	Aska Huang
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Refer to Appendix F.

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#### 3.7 Number of Dwell Time

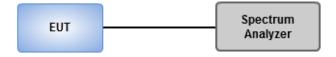
#### 3.7.1 Limit of Dwell time

	Time of Occupancy (Dwell Time) Limit for Frequency Hopping Systems					
$\boxtimes$	902-928 MHz Band:					
		$\leq$ 0.4 second within a 20 second period, 20 dB bandwidth of the hopping channel is less than 250 kHz				
		$\leq$ 0.4 second within a 10 second period, 20 dB bandwidth of the hopping channel is 250 kHz or greater				
		Hybrid mode ,an average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4				

#### 3.7.2 Test Procedures

- 1. Set RBW=200kHz, VBW=1000kHz, Sweep time=3.2s / 500ms, Detector=Peak, Span=0Hz, Trace max hold for 8 hopping channels.
- 2. Set RBW=200kHz, VBW=1000kHz, Sweep time=6.4s / 500ms, Detector=Peak, Span=0Hz, Trace max hold for 16 hopping channels.
- 3. Set RBW=200kHz, VBW=1000kHz, Sweep time=25.6s / 500ms, Detector=Peak, Span=0Hz, Trace max hold for 64 hopping channels.
- 4. Measure and record the burst on time.

#### 3.7.3 Test Setup



#### 3.7.4 Test Results

Ambient Condition	23~24°C / 65~68%	Tested By	Aska Huang
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Refer to Appendix G.

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#### 3.8 AC Power Line Conducted Emissions

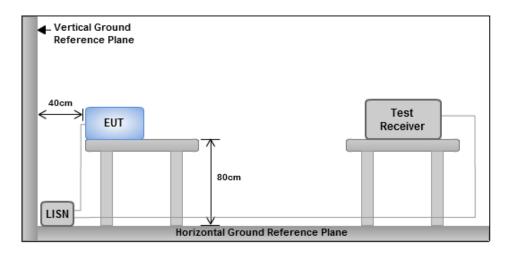
#### 3.8.1 Limit of AC Power Line Conducted Emissions

Conducted Emissions Limit					
Conducted Emissions Limit					
Frequency Emission (MHz)	Quasi-Peak	Average			
0.15-0.5	66 - 56 *	56 - 46 *			
0.5-5	56	46			
5-30	60	50			
Note 1: * Decreases with the logarithm of the frequency.					

#### 3.8.2 Test Procedures

- 1. The device is placed on a test table, raised 80 cm above the reference ground plane. The vertical conducting plane is located 40 cm to the rear of the device.
- 2. The device is connected to line impedance stabilization network (LISN) and other accessories are connected to other LISN. Measured levels of AC power line conducted emission are across the 50  $\Omega$  LISN port.
- 3. AC conducted emission measurements is made over frequency range from 150 kHz to 30 MHz.
- 4. This measurement was performed with AC 120V / 60Hz.

#### 3.8.3 Test Setup



Note: 1. Support units were connected to second LISN.

Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

#### 3.8.4 Test Result of Conducted Emissions

Refer to Appendix H.

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# 4 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corporation (EMC and Wireless Communication Laboratory), it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan District. Location map can be found on our website <a href="http://www.icertifi.com.tw">http://www.icertifi.com.tw</a>.

#### Linkou

Tel: 886-2-2601-1640 No.30-2, Ding Fwu Tsuen, Lin Kou District, New Taipei City, Taiwan (R.O.C.)

#### Kwei Shan

Tel: 886-3-271-8666
No.3-1, Lane 6, Wen San 3rd
St., Kwei Shan Dist., Tao Yuan
City 33381, Taiwan (R.O.C.)
No.2-1, Lane 6, Wen San 3rd
St., Kwei Shan Dist., Tao Yuan
City 33381, Taiwan (R.O.C.)

#### Kwei Shan Site II

Tel: 886-3-271-8640 No.14-1, Lane 19, Wen San 3rd St., Kwei Shan Dist., Tao Yuan City 333, Taiwan (R.O.C.)

If you have any suggestion, please feel free to contact us as below information.

Tel: 886-3-271-8666 Fax: 886-3-318-0345

Email: ICC Service@icertifi.com.tw

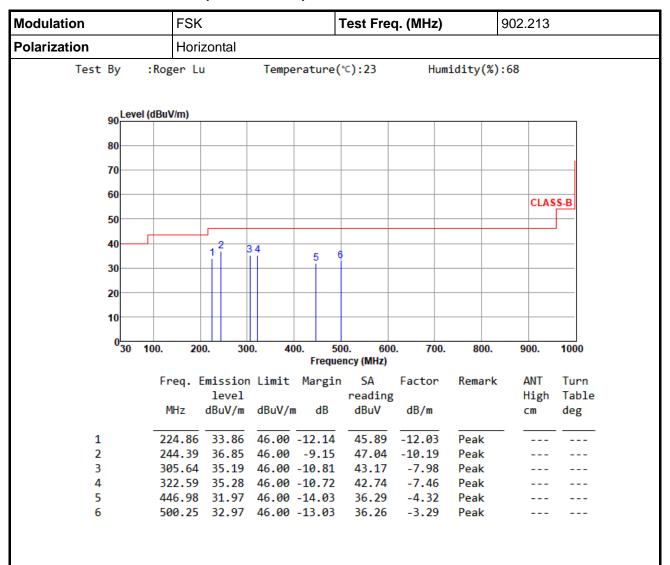
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#### Model: CL4490-1000-232

#### TX Unwanted Emissions (Below 1GHz)



Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

\*Factor includes antenna factor , cable loss and amplifier gain

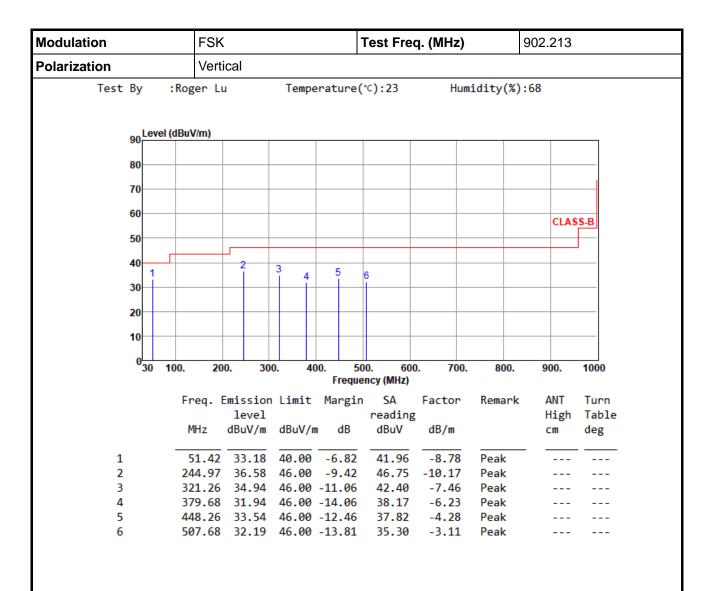
Note 2: Margin (dB) = Emission level (dBuV/m) - Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

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Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

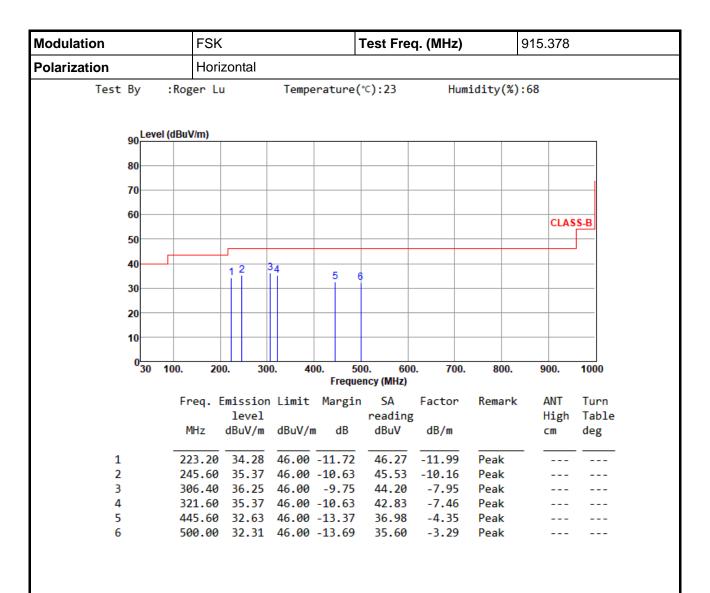
\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

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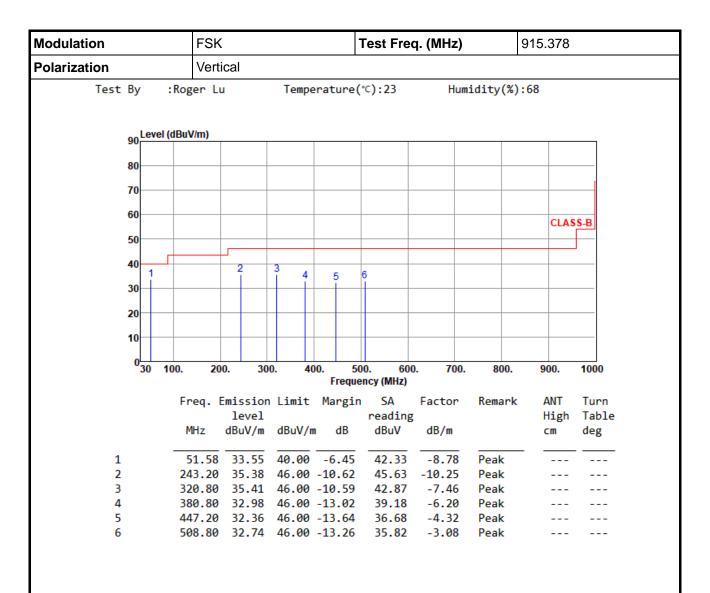
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) - Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.





Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

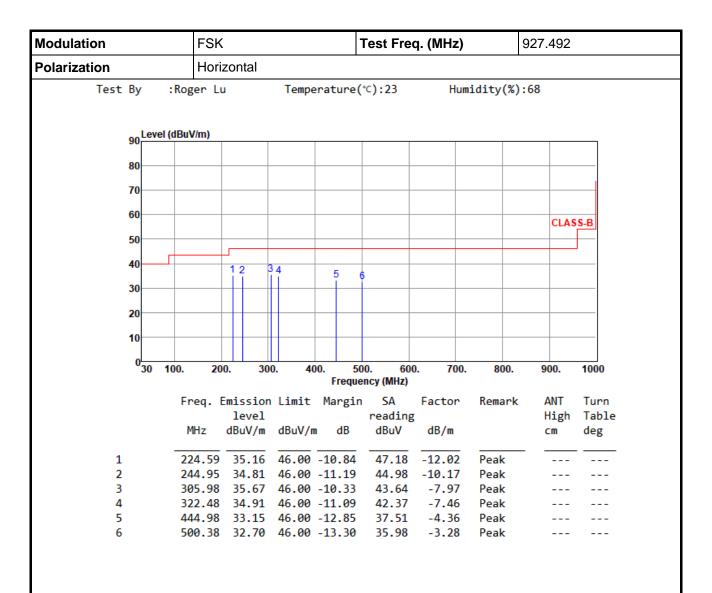
\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

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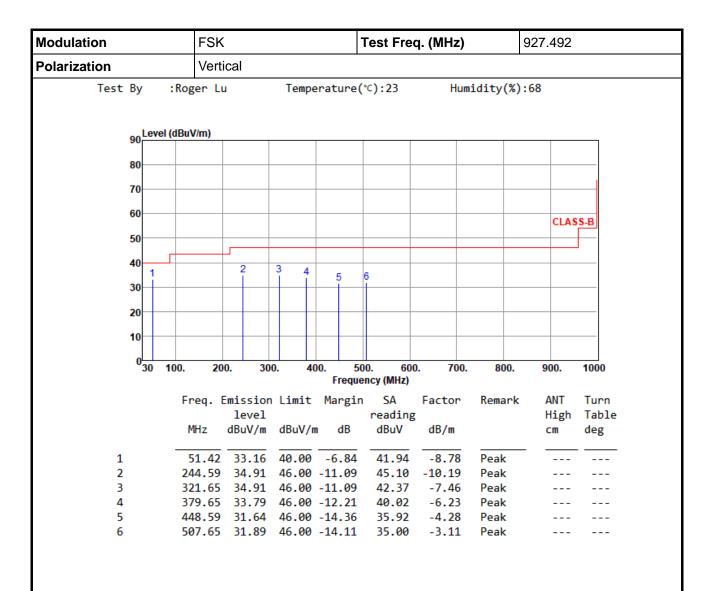
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

\*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) - Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.





Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

\*Factor includes antenna factor, cable loss and amplifier gain

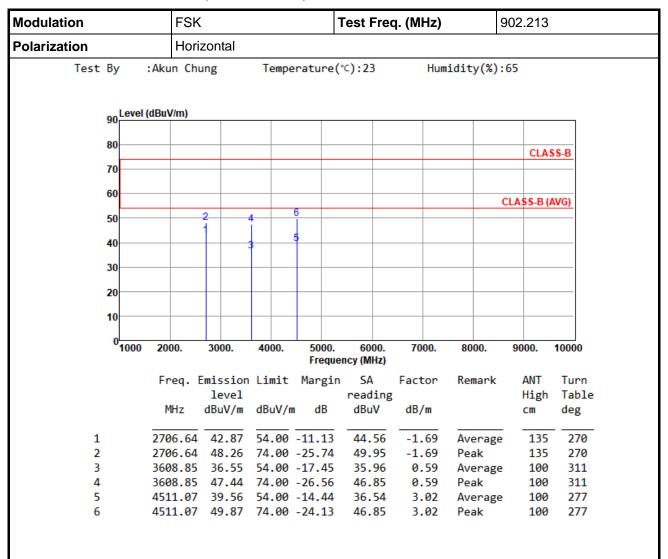
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

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### **TX Unwanted Emissions (Above 1GHz)**



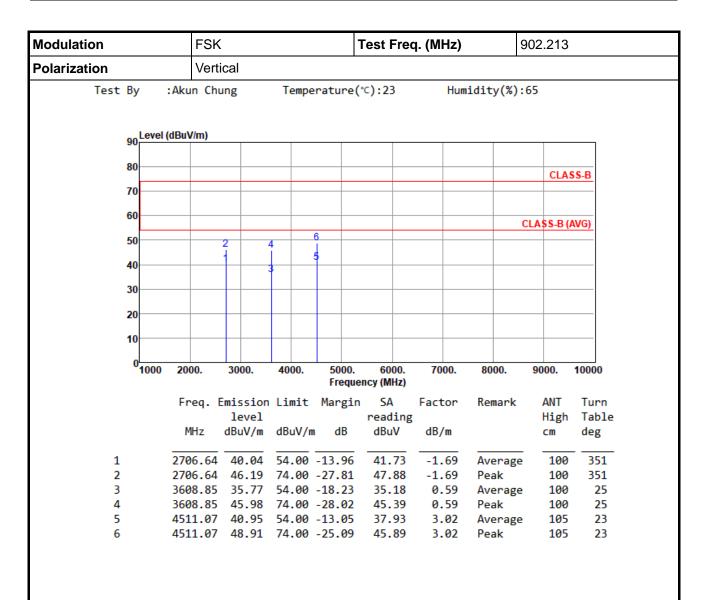
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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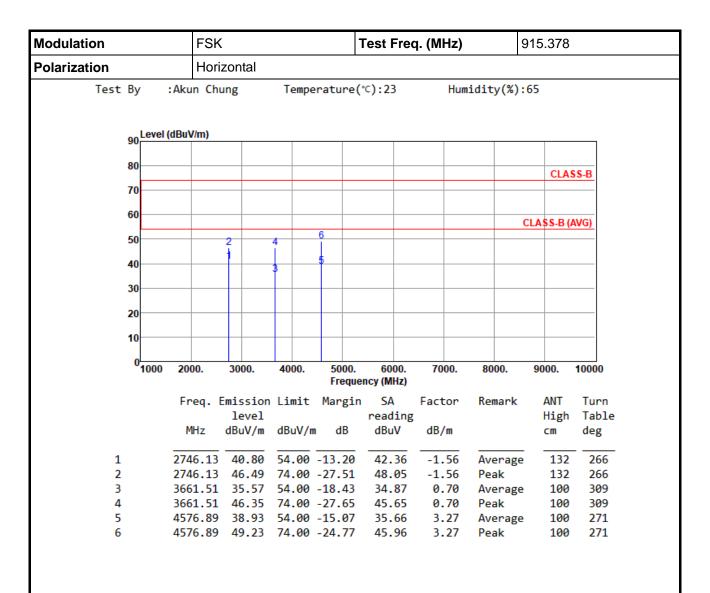




Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

\*Factor includes antenna factor , cable loss and amplifier gain

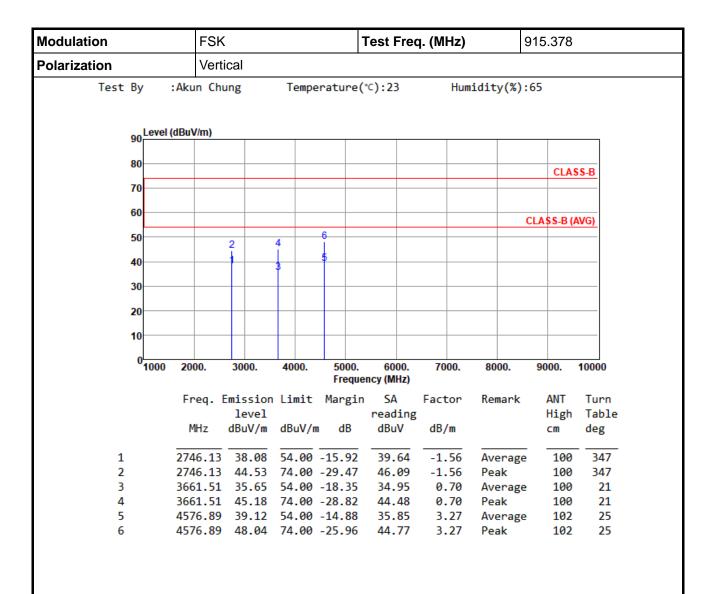




Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

\*Factor includes antenna factor , cable loss and amplifier gain

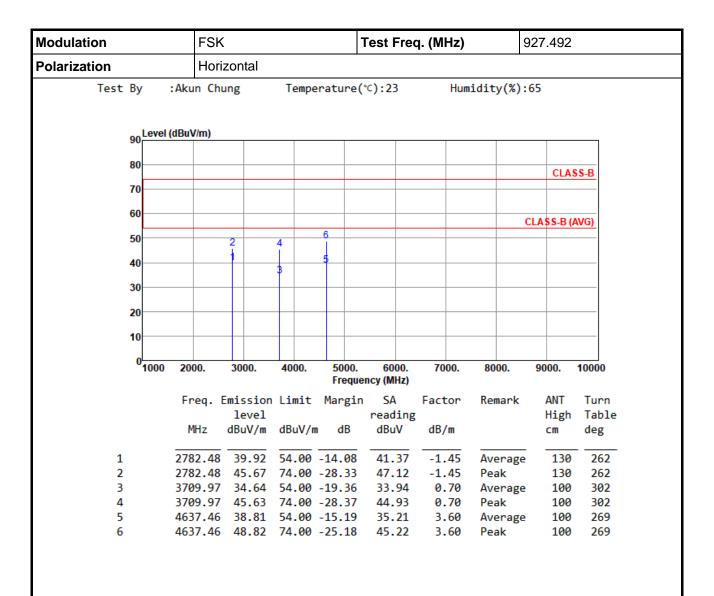




Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

\*Factor includes antenna factor , cable loss and amplifier gain

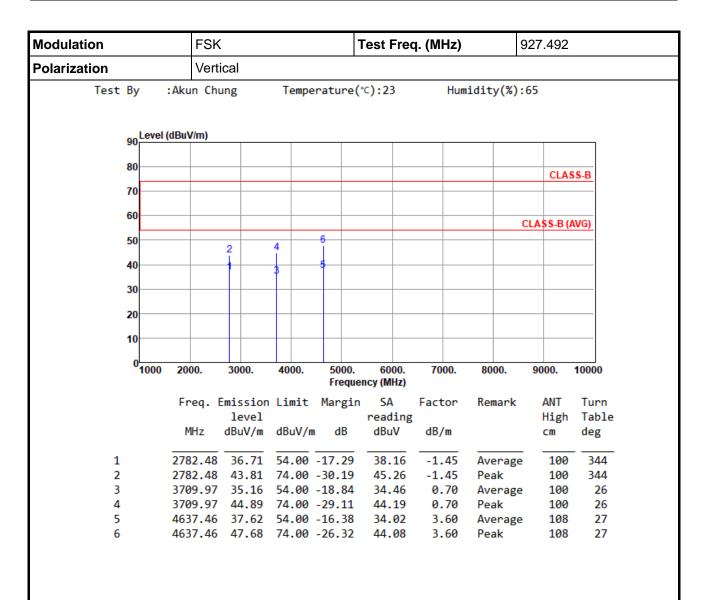




Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

\*Factor includes antenna factor , cable loss and amplifier gain





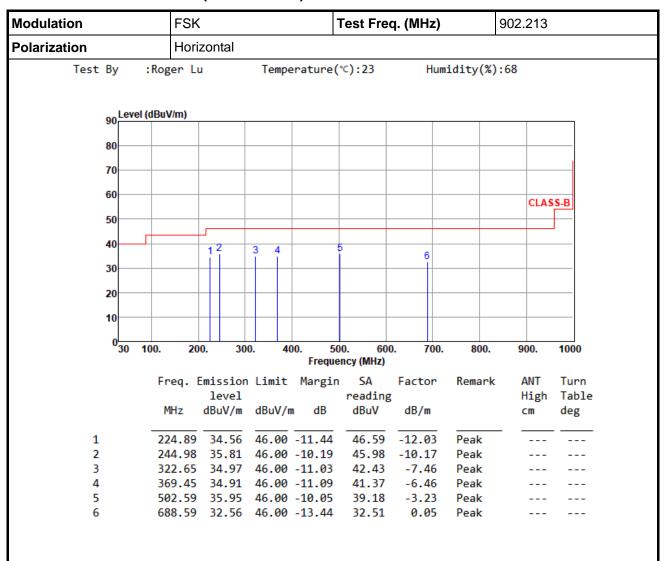
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

\*Factor includes antenna factor , cable loss and amplifier gain



#### Model: CL4490-1000-485

#### TX Unwanted Emissions (Below 1GHz)



Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

\*Factor includes antenna factor , cable loss and amplifier gain

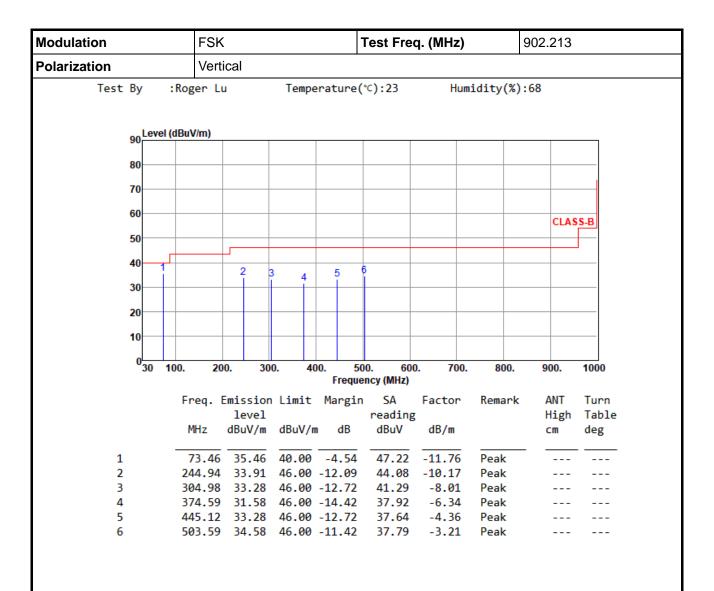
Note 2: Margin (dB) = Emission level (dBuV/m) - Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

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Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

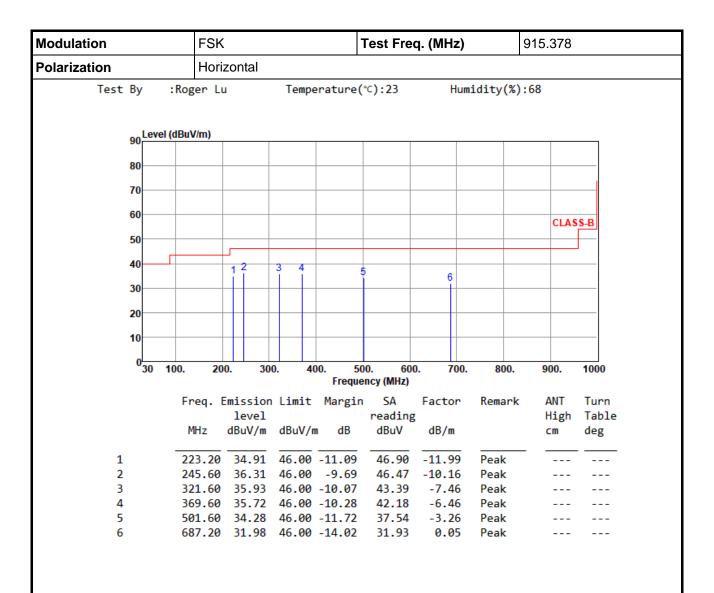
\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

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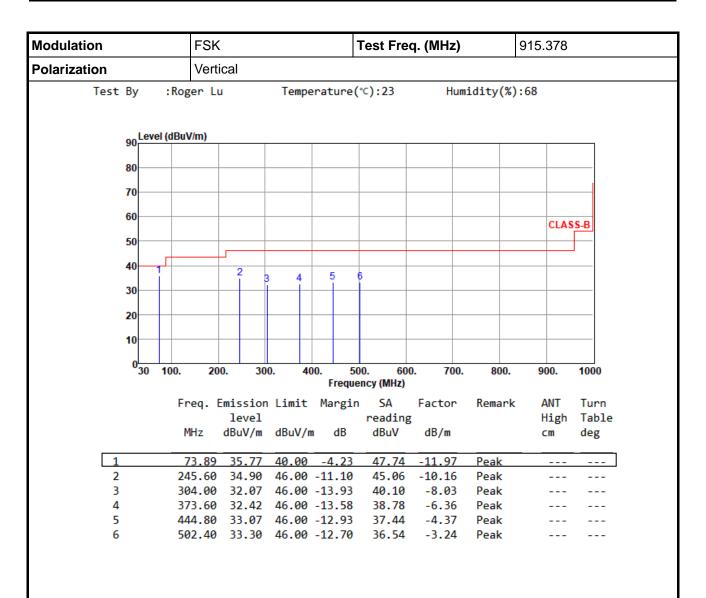
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) - Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.





Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

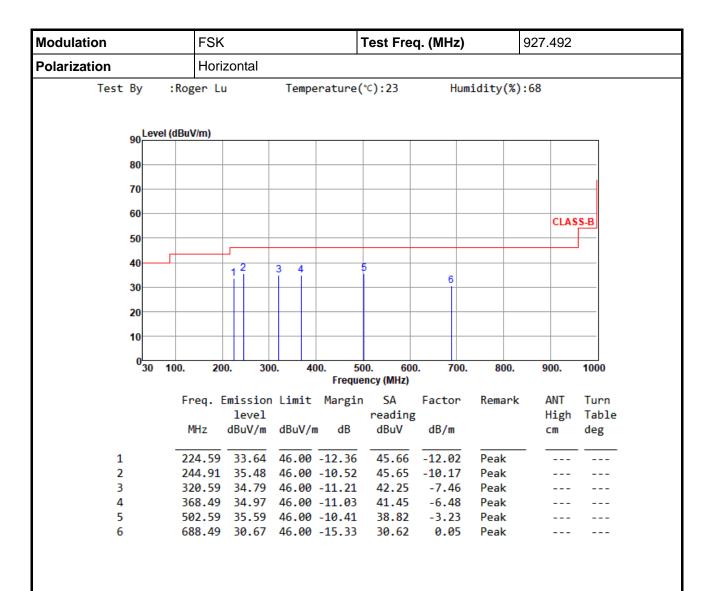
\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

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Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

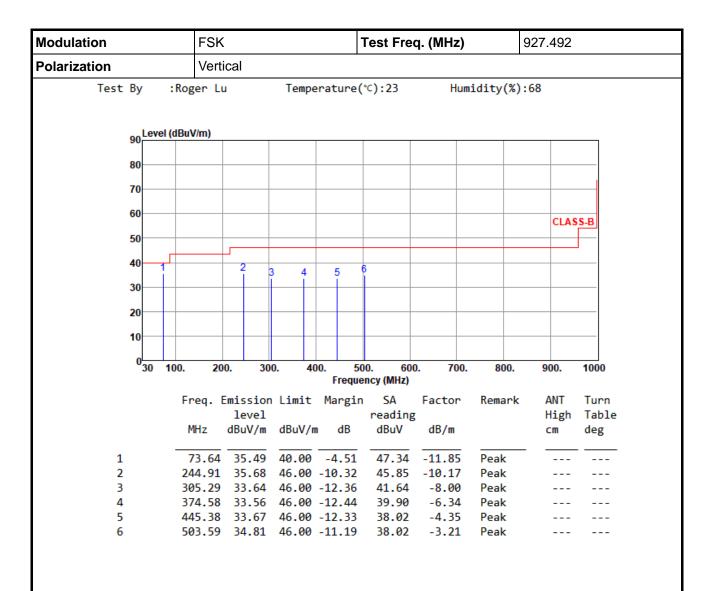
\*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) - Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

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Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

\*Factor includes antenna factor, cable loss and amplifier gain

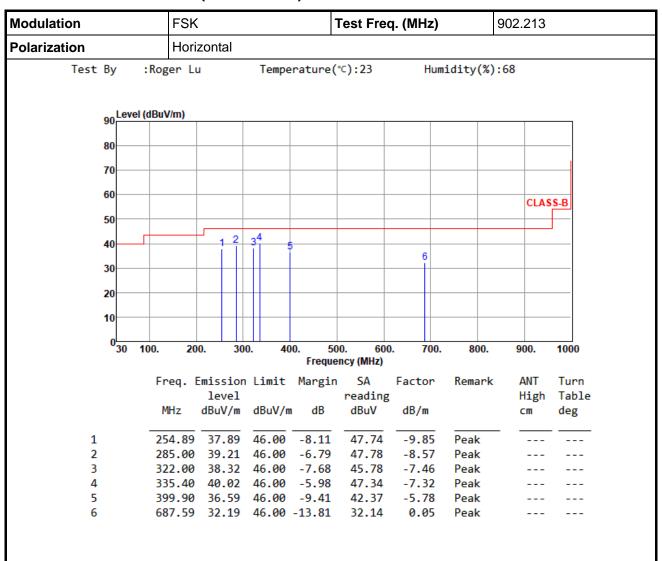
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

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#### TX Unwanted Emissions (Below 1GHz)



Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

\*Factor includes antenna factor , cable loss and amplifier gain

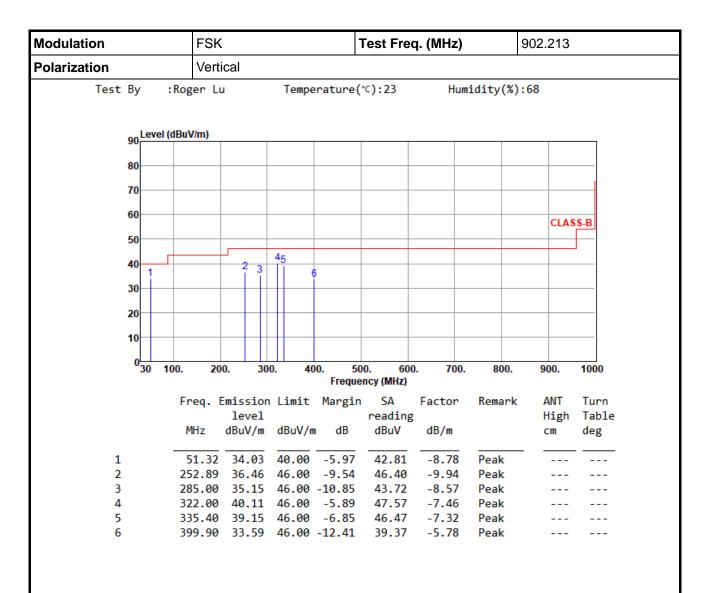
Note 2: Margin (dB) = Emission level (dBuV/m) - Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

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Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

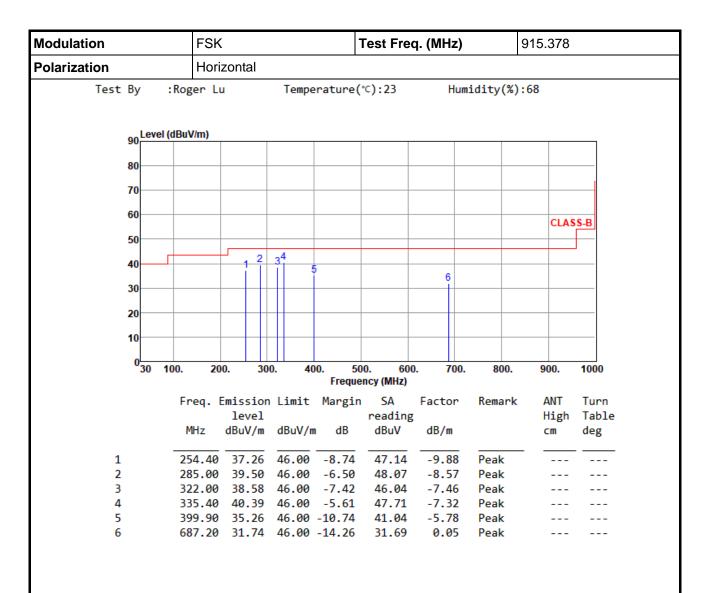
\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

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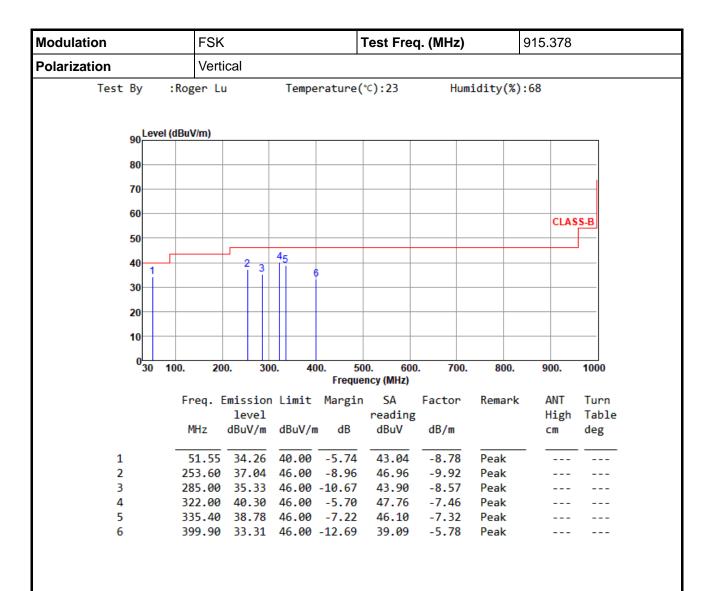
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

\*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) - Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.





Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

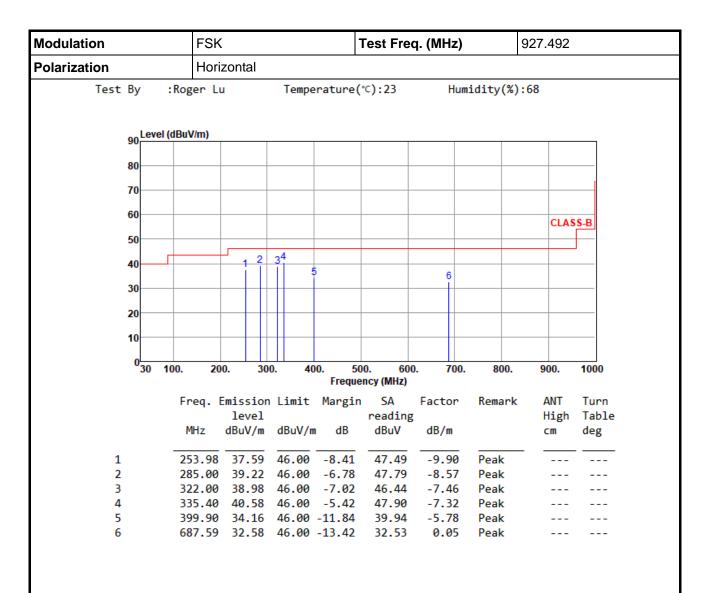
\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

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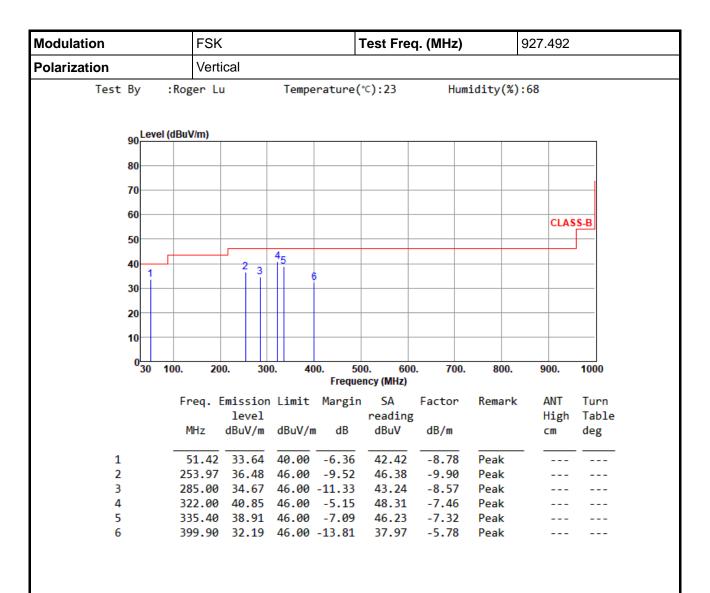
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) - Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.





Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

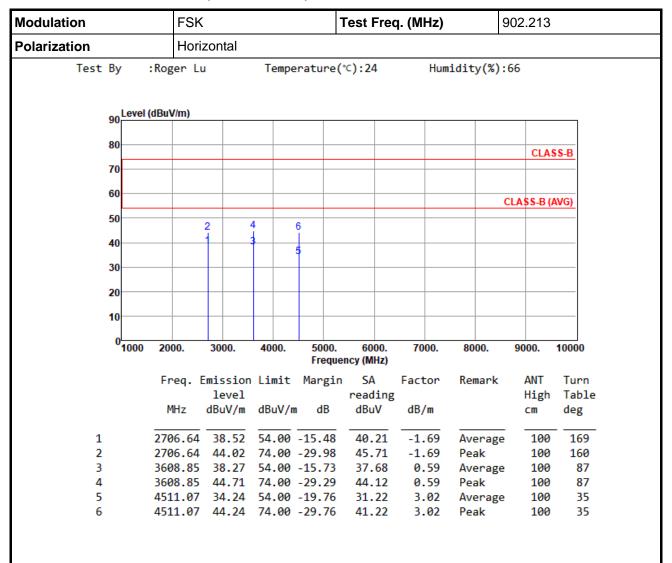
\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.



# **TX Unwanted Emissions (Above 1GHz)**



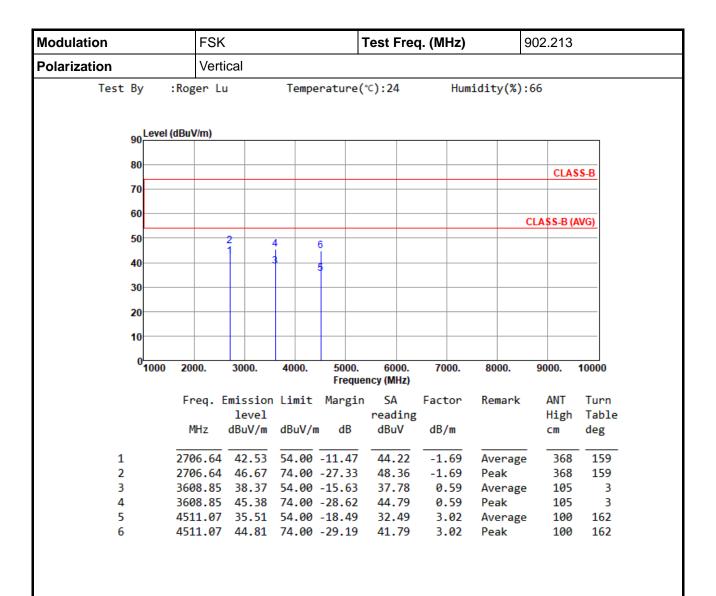
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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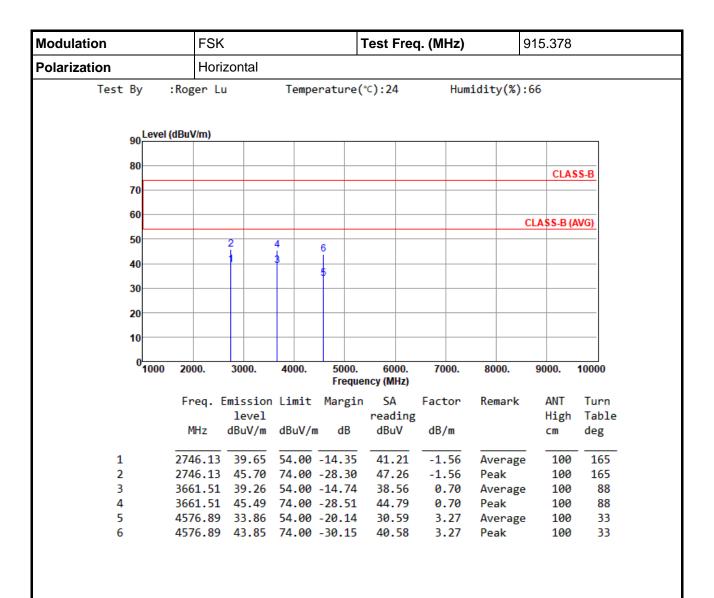


Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) - Limit (dBuV/m).



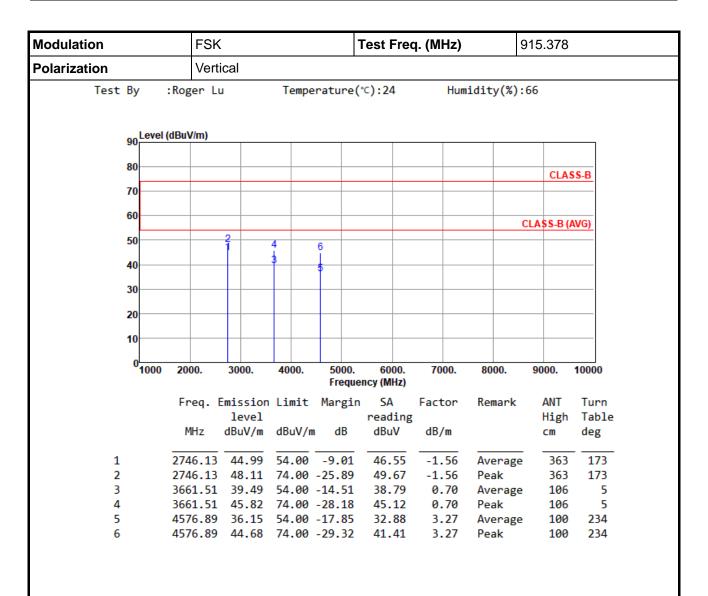


Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).



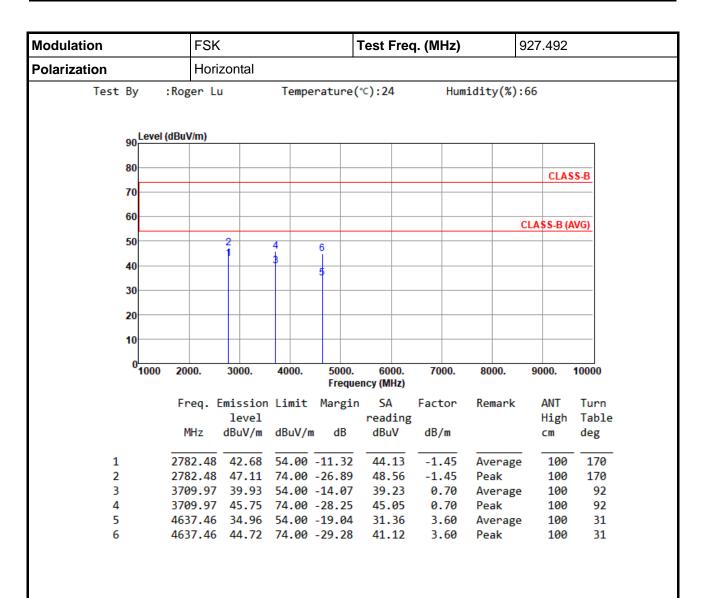


Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).



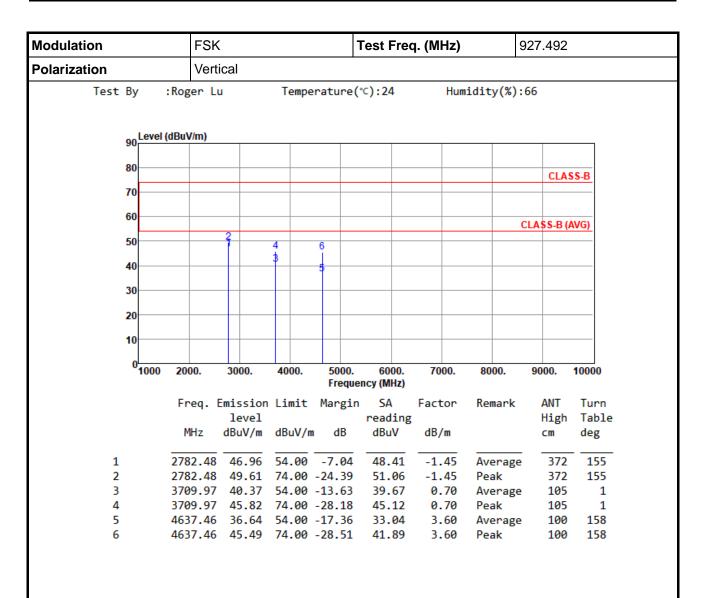


Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) - Limit (dBuV/m).



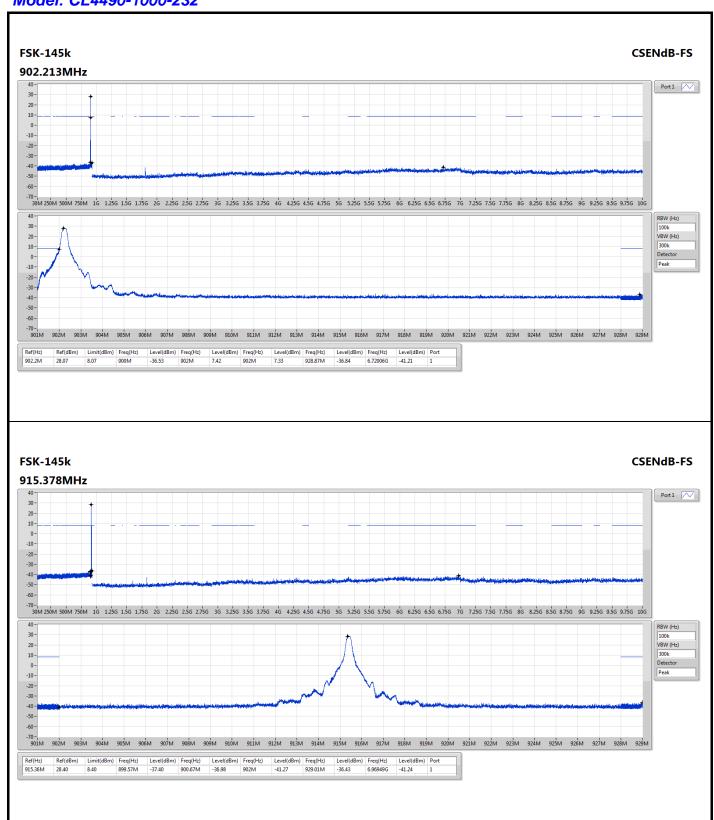


Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

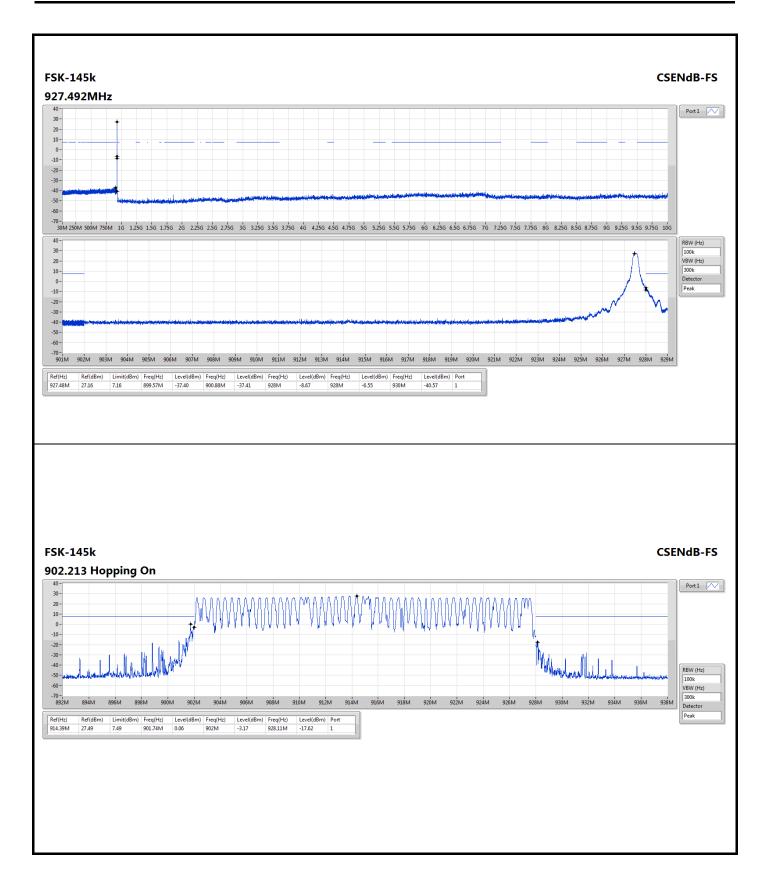
\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) - Limit (dBuV/m).

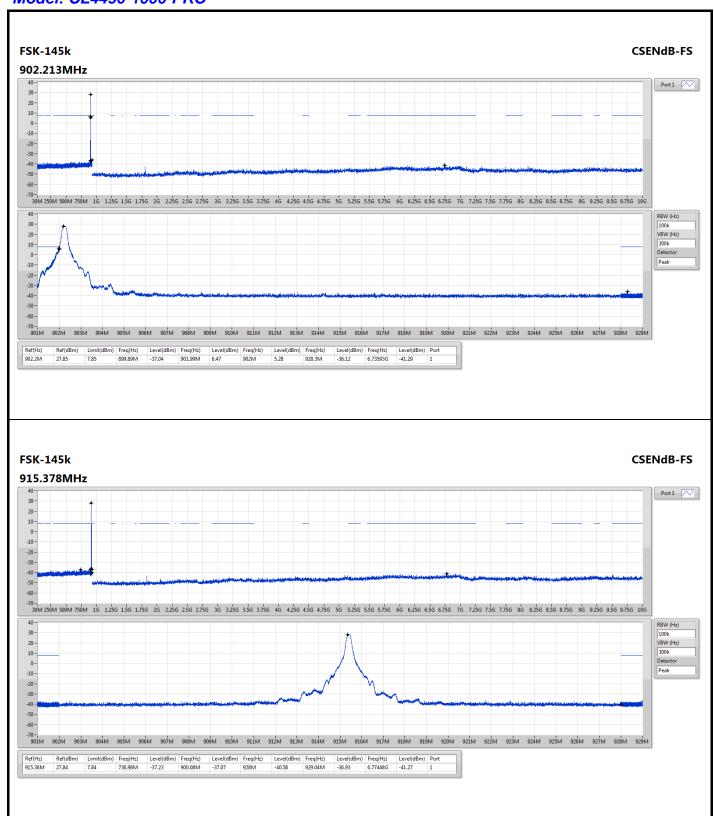




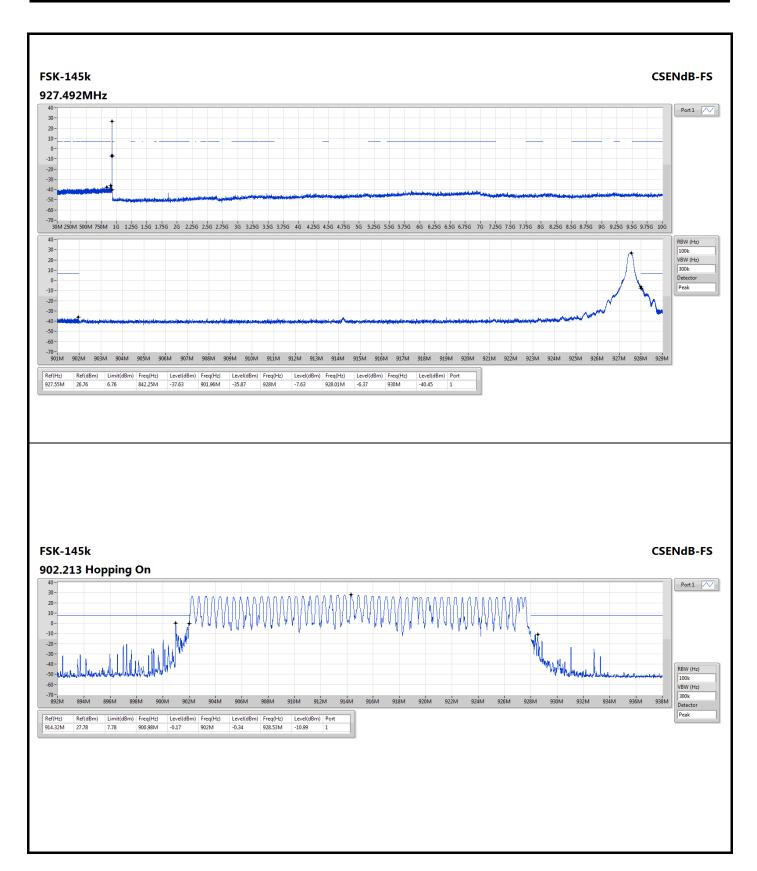














Summary

Mode	Power (dBm)	Power (W)
902-928MHz	-	-
FSK-145k	28.12	0.64863

#### Result

Mode	Result	Antenna Gain (dBi)	Power (dBm)	Power Limit (dBm)
FSK-145k	-	-	-	-
902.213MHz	Pass	2.00	27.70	30.00
915.378MHz	Pass	2.00	28.12	30.00
927.492MHz	Pass	2.00	26.86	30.00

# Model: CL4490-1000-PRO

**Summary** 

Mode	Power (dBm)	Power (W)
902-928MHz	-	-
FSK-145k	27.61	0.57677

#### Result

Mode	Result	Antenna Gain (dBi)	Power (dBm)	Power Limit (dBm)
FSK-145k	-	-	-	-
902.213MHz	Pass	2.00	27.57	30.00
915.378MHz	Pass	2.00	27.61	30.00
927.492MHz	Pass	2.00	26.62	30.00



**Summary** 

Mode	Power (dBm)	Power (W)
902-928MHz	-	-
FSK-145k	28.00	0.63096

#### Result

Mode	Result	Antenna Gain (dBi)	Power (dBm)	Power Limit (dBm)
FSK-145k	-	-	-	-
902.213MHz	Pass	2.00	27.62	-
915.378MHz	Pass	2.00	28.00	-
927.492MHz	Pass	2.00	26.78	-

Note: Average power is for reference only.

# Model: CL4490-1000-PRO

**Summary** 

Mode	Power (dBm)	Power (W)
902-928MHz	-	-
FSK-145k	27.51	0.56364

#### Result

Mode	Result	Antenna Gain (dBi)	Power (dBm)	Power Limit (dBm)
FSK-145k	-	-	-	-
902.213MHz	Pass	2.00	27.49	-
915.378MHz	Pass	2.00	27.51	-
927.492MHz	Pass	2.00	26.54	-

Note: Average power is for reference only.

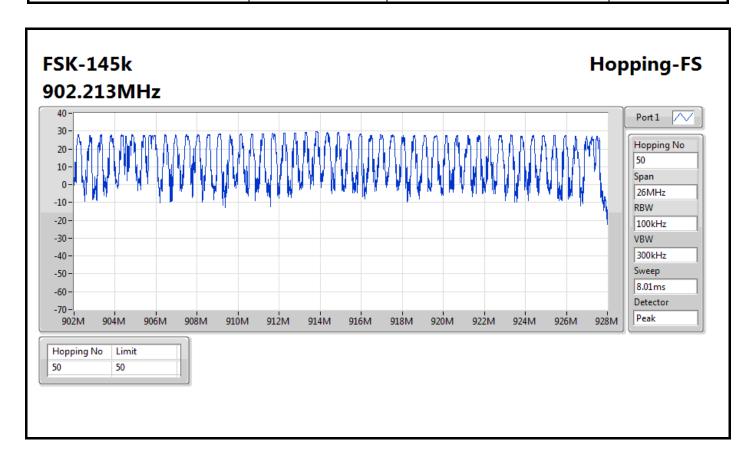


**Summary** 

Mode	Мах-Нор No
902-928MHz	-
FSK-145k	50

#### Result

Mode	Result	Hopping No	Limit
FSK-145k	-	-	-
902.213MHz	Pass	50	50



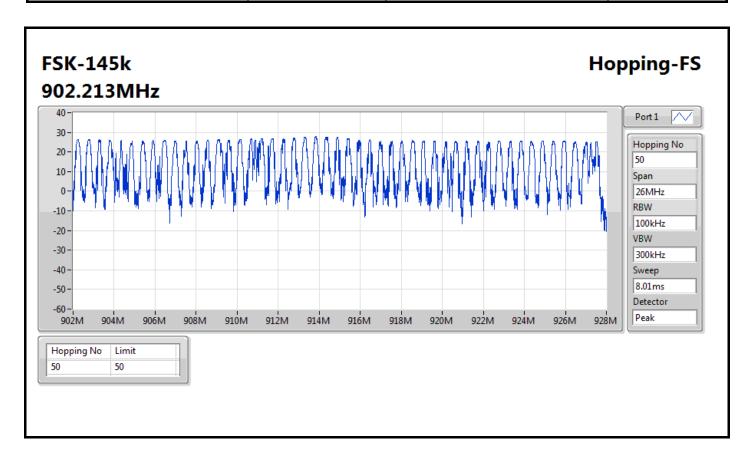


**Summary** 

Mode	Max-Hop No
902-928MHz	-
FSK-145k	50

#### Result

Mode	Result	Hopping No	Limit
FSK-145k	-	-	-
902.213MHz	Pass	50	50









**Summary** 

Mode	Max-N dB (Hz)	Max-OBW (Hz)	ITU-Code	Min-N dB (Hz)	Min-OBW (Hz)
902-928MHz	-	-	-	-	-
FSK-145k	170.29k	309.334k	309KF1D	148.551k	211.65k

Max-N dB = Maximum 20dB down bandwidth; Max-OBW = Maximum 99% occupied bandwidth; Min-N dB = Minimum 20dB down bandwidth; Min-OBW = Minimum 99% occupied bandwidth

#### Result

Mode	Result	Limit	Port 1-N dB	Port 1-OBW
		(Hz)	(Hz)	(Hz)
FSK-145k	-	-	-	-
902.213MHz	Pass	Inf	170.29k	280.391k
915.378MHz	Pass	Inf	148.551k	309.334k
927.492MHz	Pass	Inf	168.478k	211.65k

Port X-N dB = Port X 20dB down bandwidth; Port X-OBW = Port X 99% occupied bandwidth

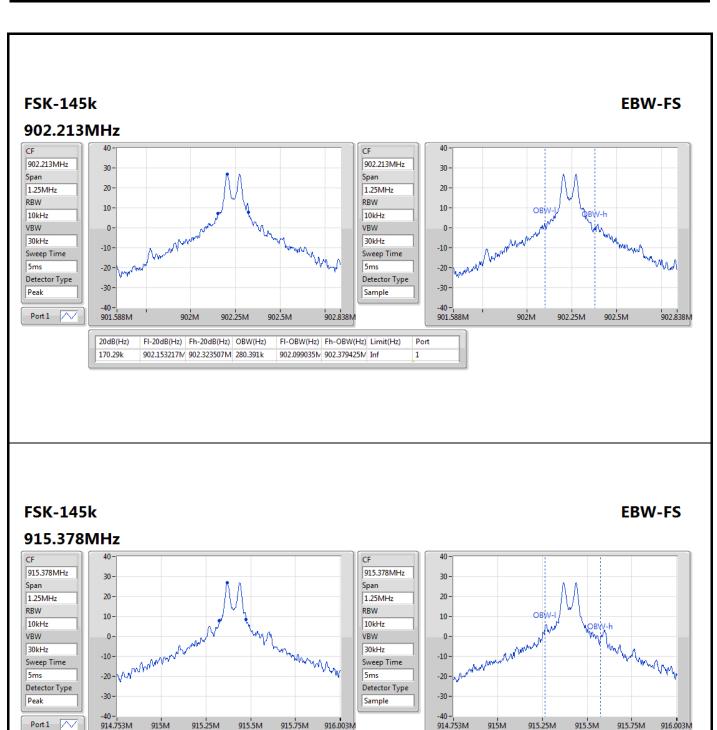


20dB(Hz)

148.551k

FI-20dB(Hz) Fh-20dB(Hz) OBW(Hz)

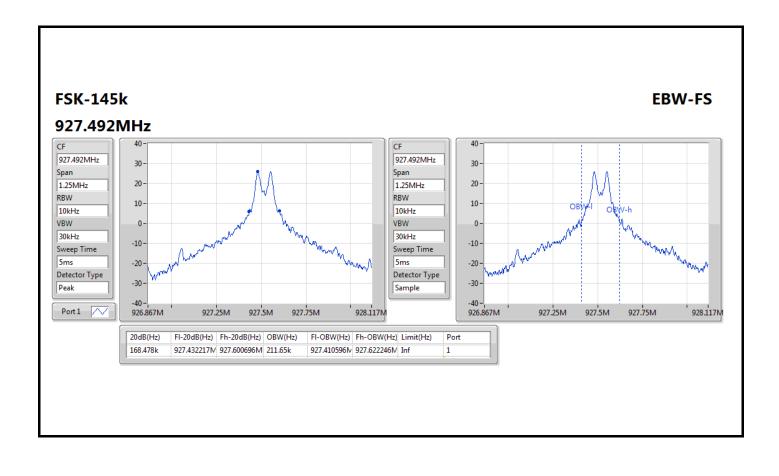
915.325464N 915.474014M 309.334k



FI-OBW(Hz) Fh-OBW(Hz) Limit(Hz)

915.264035N 915.573369N Inf











**Summary** 

Mode	Max-N dB (Hz)	Max-OBW (Hz)	ITU-Code	Min-N dB (Hz)	Min-OBW (Hz)
902-928MHz	-	-	-	-	-
FSK-145k	219.203k	350.941k	351KF1D	164.855k	289.436k

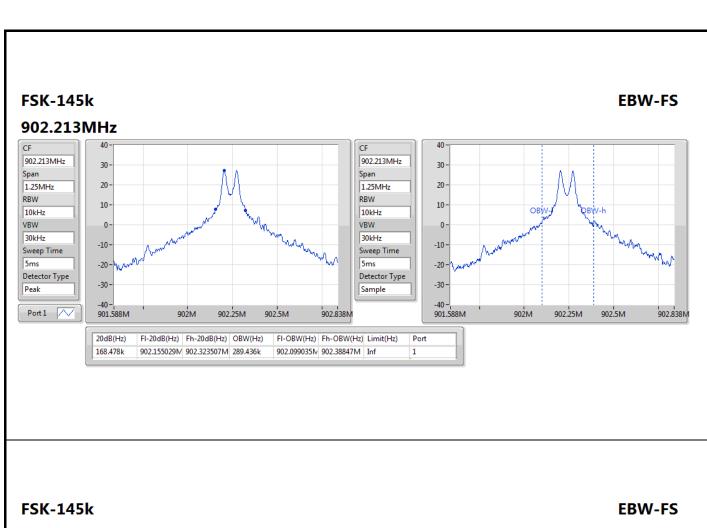
Max-N dB = Maximum 20dB down bandwidth; Max-OBW = Maximum 99% occupied bandwidth; Min-N dB = Minimum 20dB down bandwidth; Min-OBW = Minimum 99% occupied bandwidth

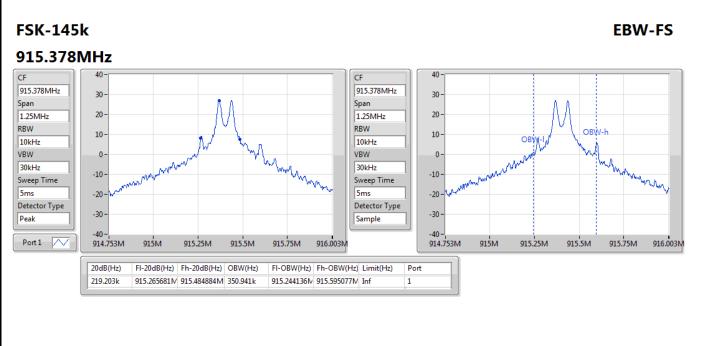
#### Result

Mode	Result	Limit (Hz)	Port 1-N dB (Hz)	Port 1-OBW (Hz)
FSK-145k	-	-	-	-
902.213MHz	Pass	Inf	168.478k	289.436k
915.378MHz	Pass	Inf	219.203k	350.941k
927.492MHz	Pass	Inf	164.855k	291.245k

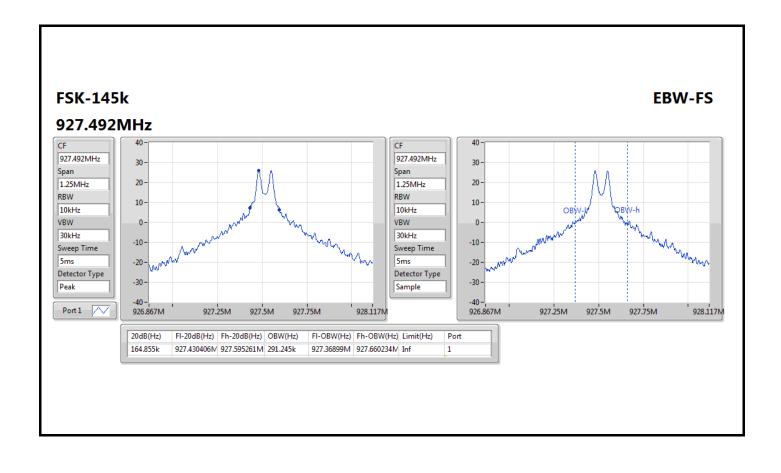
Port X-N dB = Port X 20dB down bandwidth; Port X-OBW = Port X 99% occupied bandwidth

















Summary

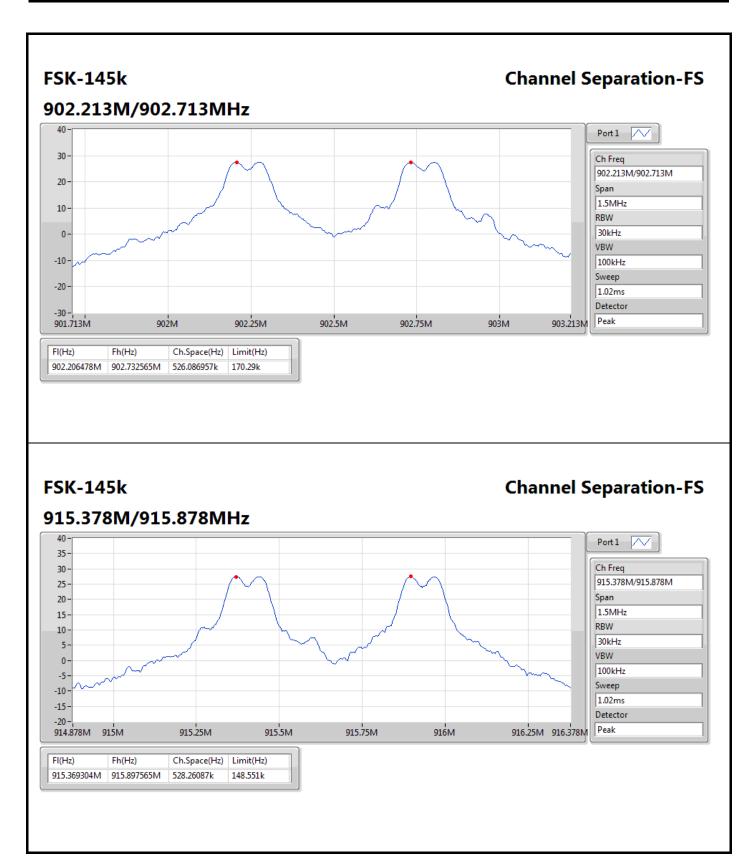
Mode	Max-Space (Hz)	Min-Space (Hz)	
902-928MHz	-	-	
FSK-145k	528.26087k	282.608696k	

#### Result

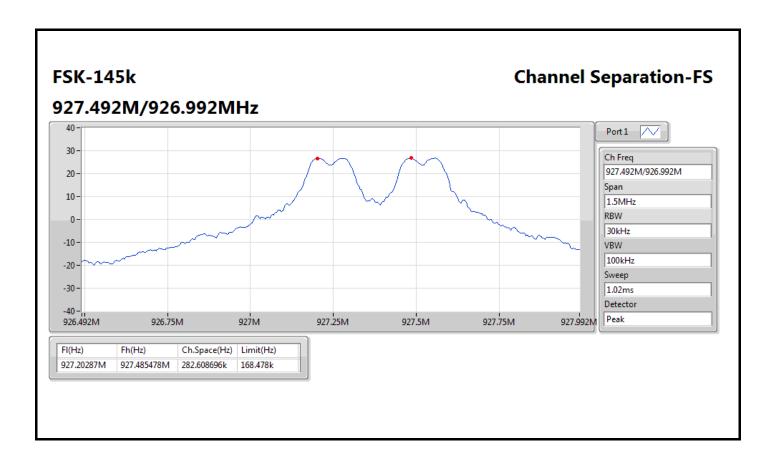
Mode	Result	FI	Fh	Ch.Space	Limit
		(Hz)	(Hz)	(Hz)	(Hz)
FSK-145k	-	-	-	-	-
902.213MHz	Pass	902.206478M	902.732565M	526.086957k	170.29k
915.378MHz	Pass	915.369304M	915.897565M	528.26087k	148.551k
927.492MHz	Pass	927.20287M	927.485478M	282.608696k	168.478k

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Appendix F

Model: CL4490-1000-PRO Summary

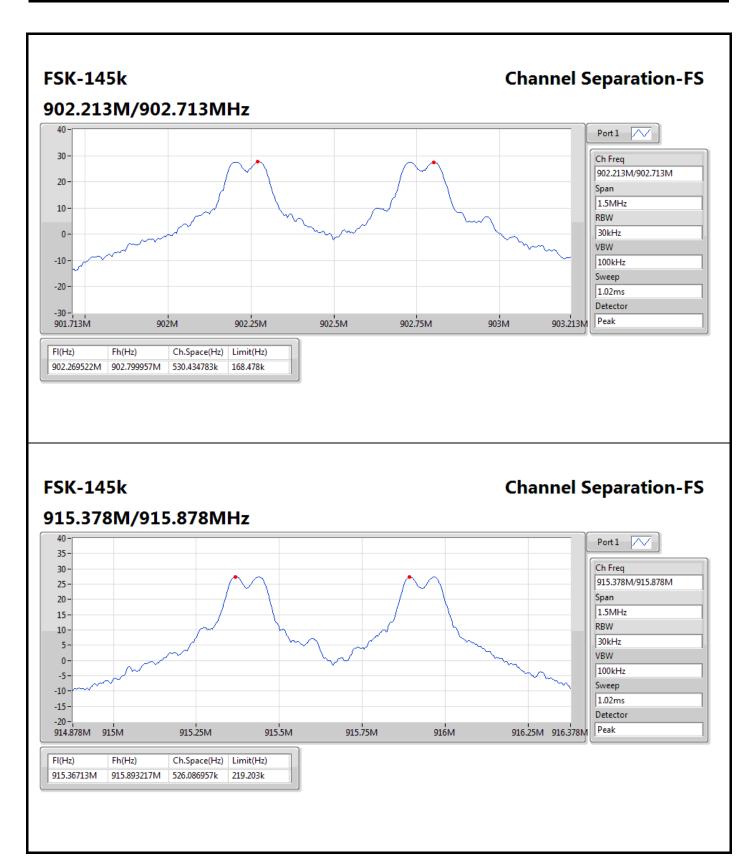
Mode	Max-Space	Min-Space	
	(Hz)	(Hz)	
902-928MHz	-	-	
FSK-145k	530.434783k	280.434783k	

#### Result

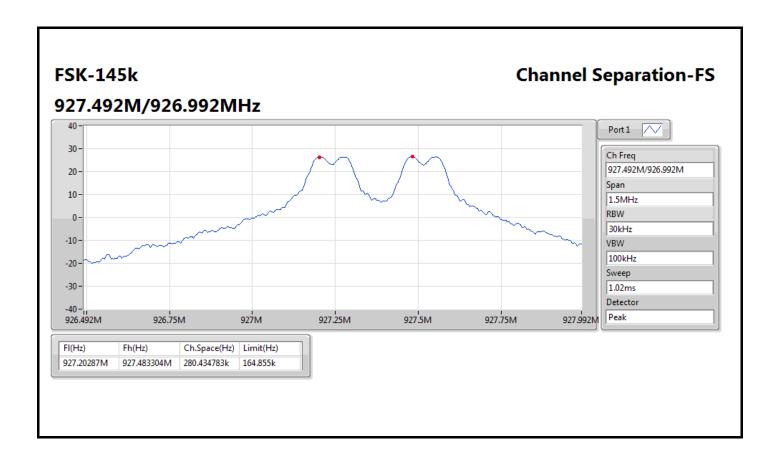
Mode	Result	FI	Fh	Ch.Space	Limit
		(Hz)	(Hz)	(Hz)	(Hz)
FSK-145k	-	-	-	-	-
902.213MHz	Pass	902.269522M	902.799957M	530.434783k	168.478k
915.378MHz	Pass	915.36713M	915.893217M	526.086957k	219.203k
927.492MHz	Pass	927.20287M	927.483304M	280.434783k	164.855k

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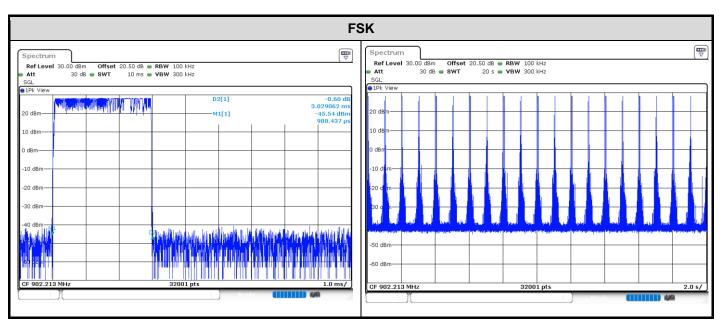




# 50 hopping channels / 20mS hop period

Model: CL4490-1000-232

Modulation Mode	Freq. (MHz)	Length of Transmission Time (sec)	Number of Transmission in a 20 S	Result (s)	Limit (s)
FSK	902.213	0.003029062	20	0.06058124	0.4



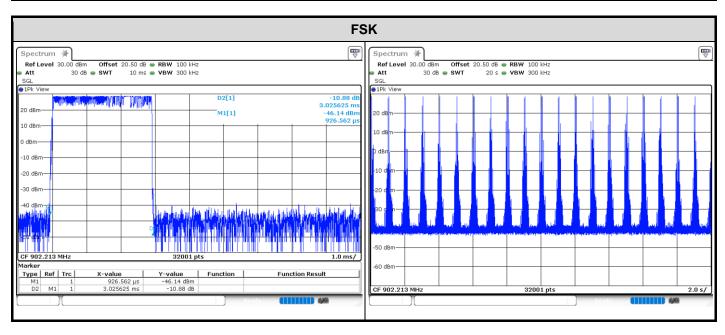
Page No. : 1 of 3



## 50 hopping channels / 20mS hop period

Model: CL4490-1000-PRO

Modulation Mode	Freq. (MHz)	Length of Transmission Time (sec)	Number of Transmission in a 20 S	Result (s)	Limit (s)
FSK	902.213	0.003025625	20	0.0605125	0.4



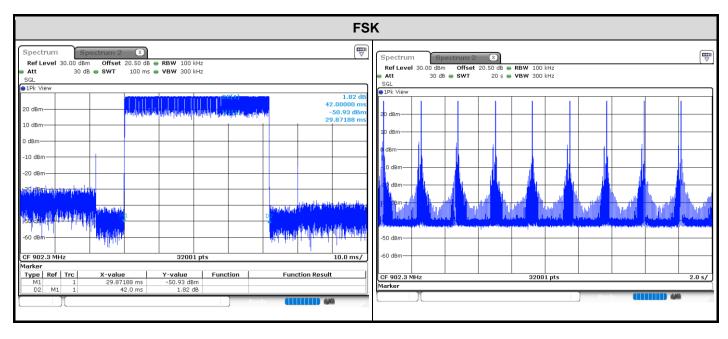
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# 50 hopping channels / 50mS hop period

Model: CL4790-1000-232

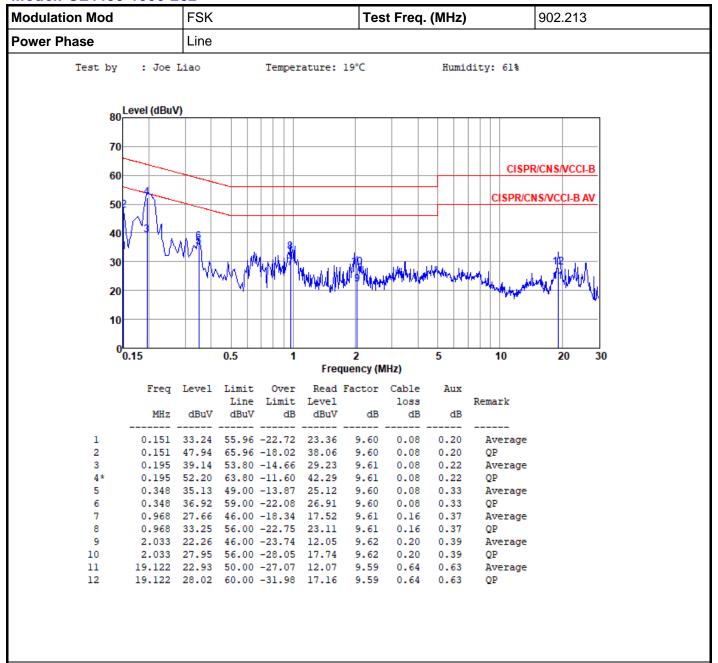
Modulation Mode	Freq. (MHz)	Length of Transmission Time (sec)	Number of Transmission in a 20 S	Result (s)	Limit (s)
FSK	902.213	0.042	9	0.378	0.4



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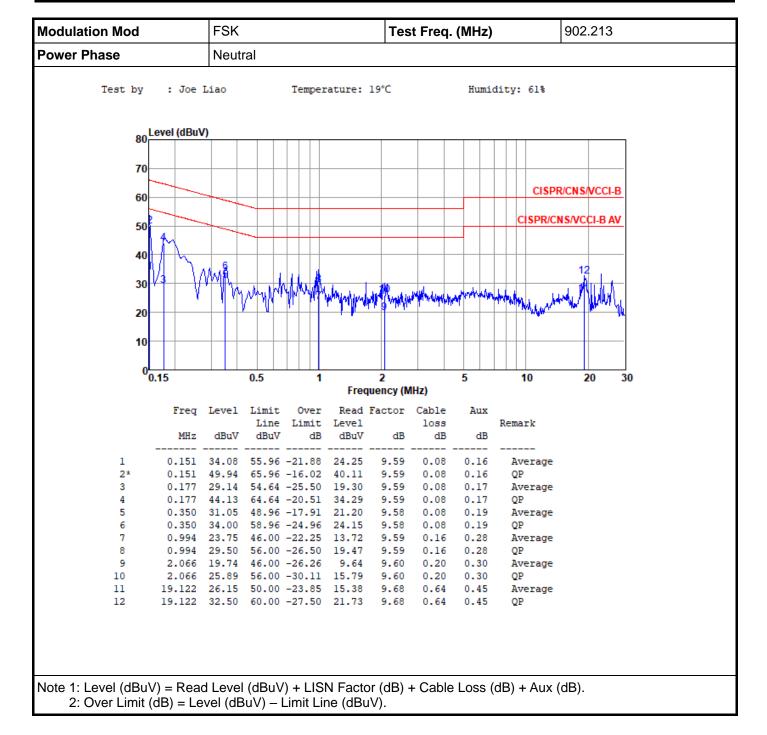
#### Model: CL4490-1000-232



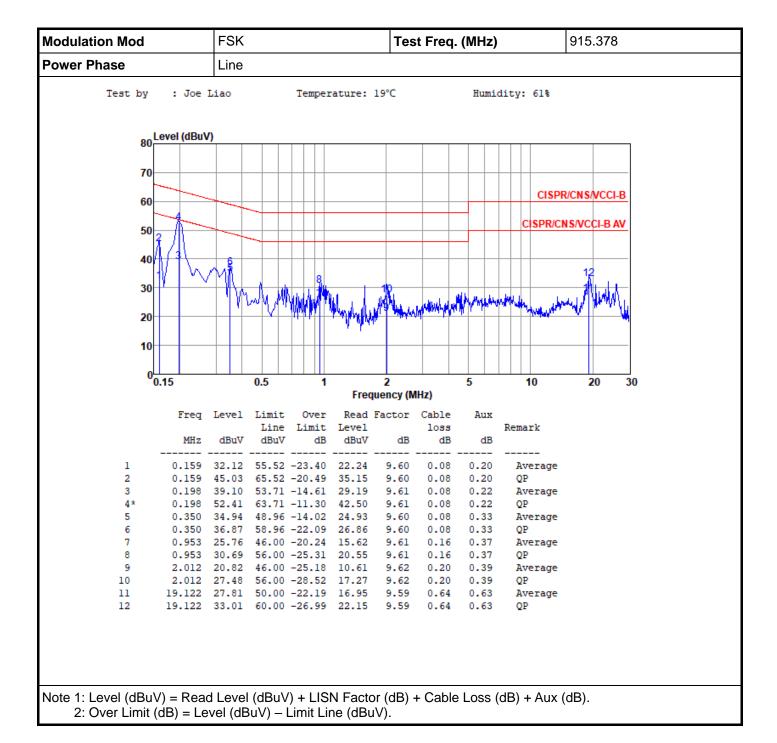
Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB) + Aux (dB).

2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).



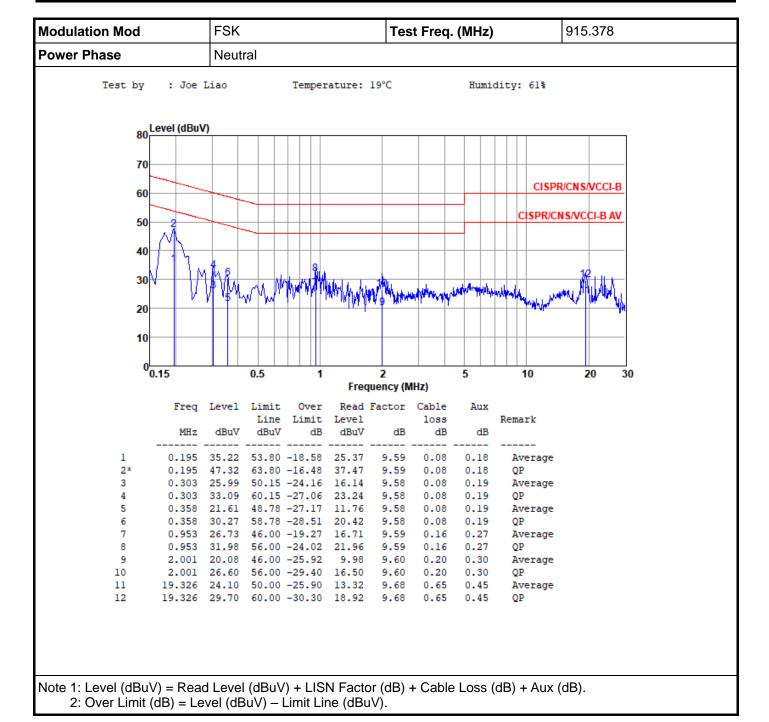






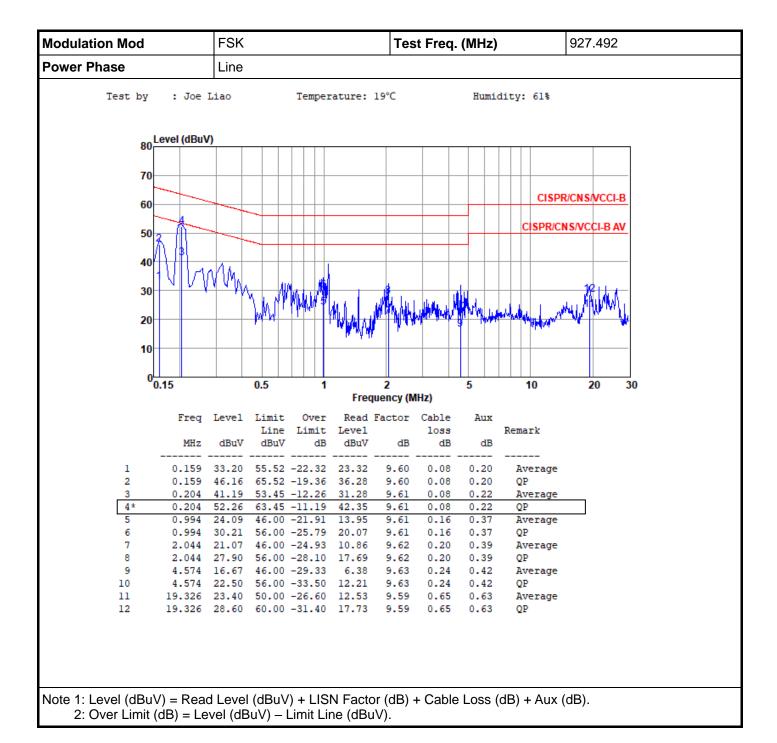
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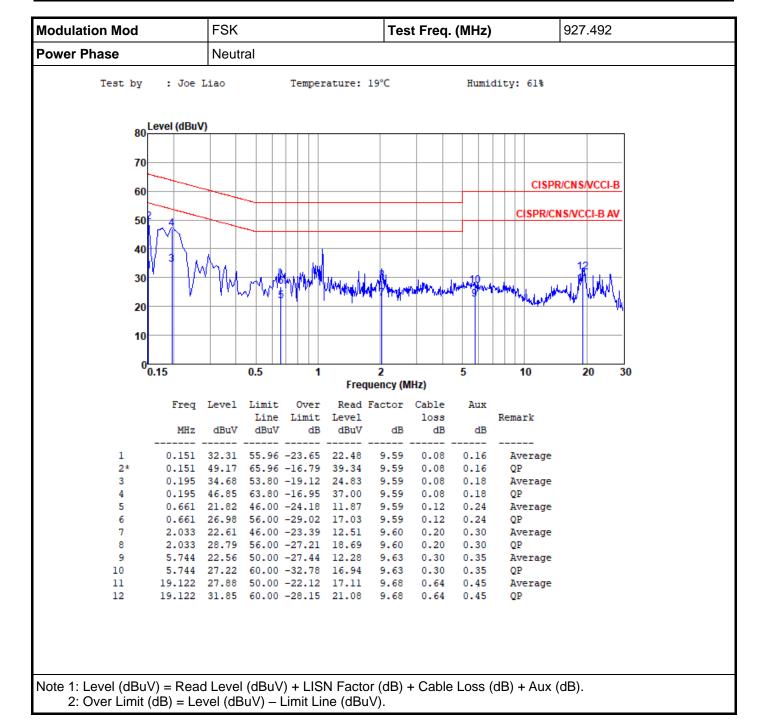
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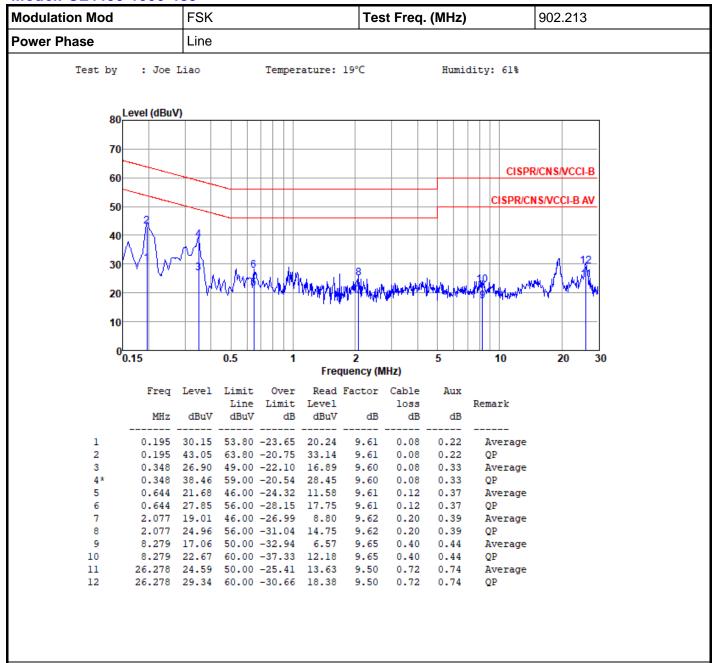
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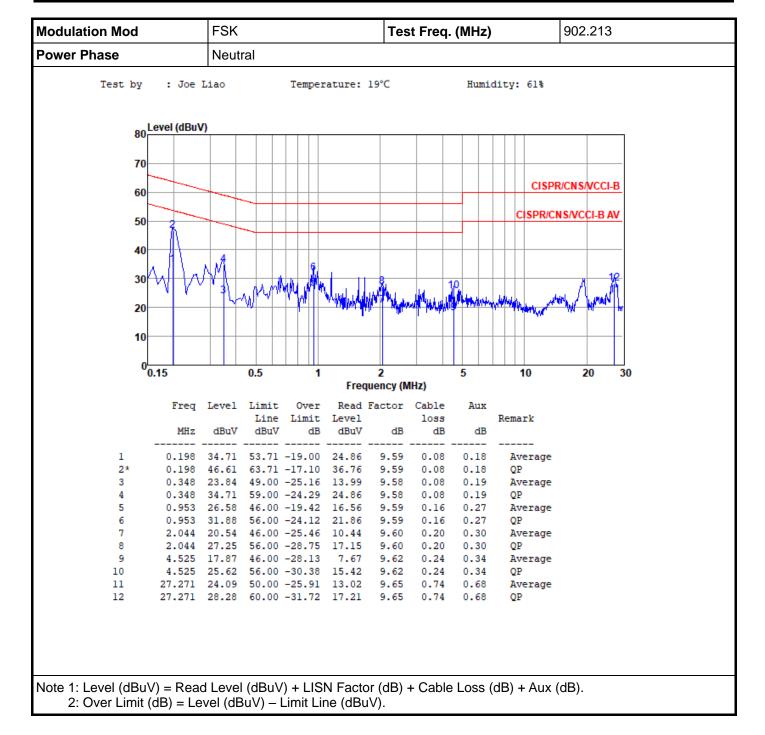
#### Model: CL4490-1000-485



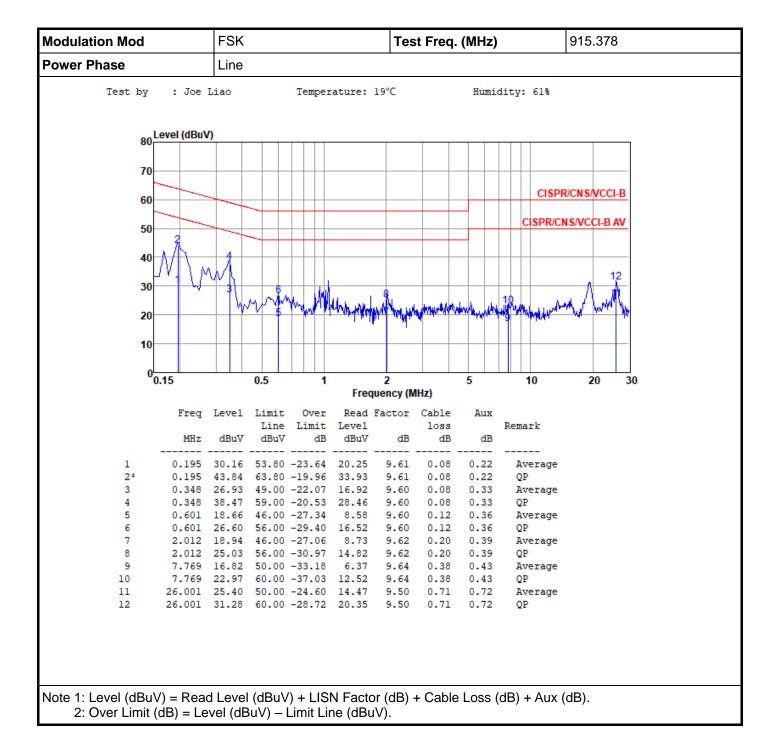
Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB) + Aux (dB).

2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).



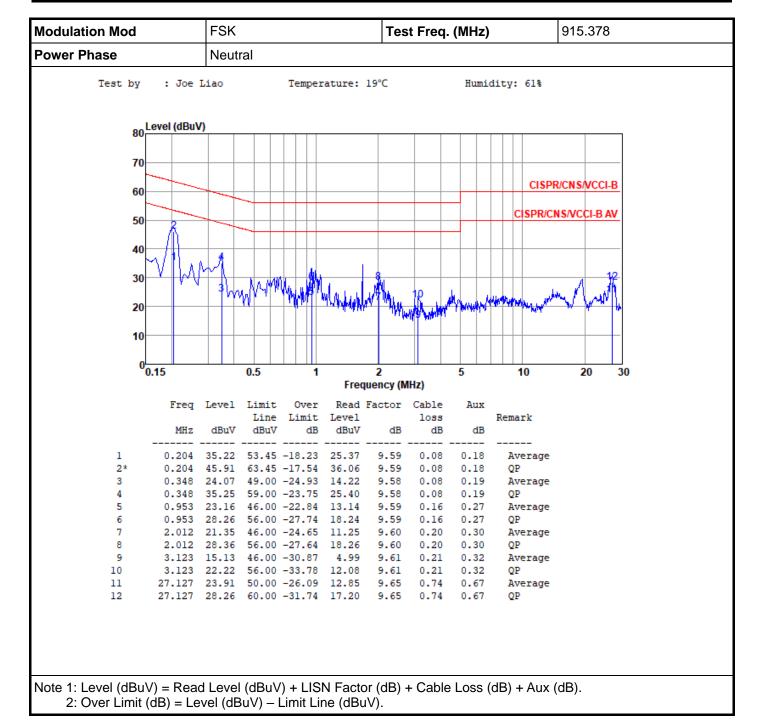






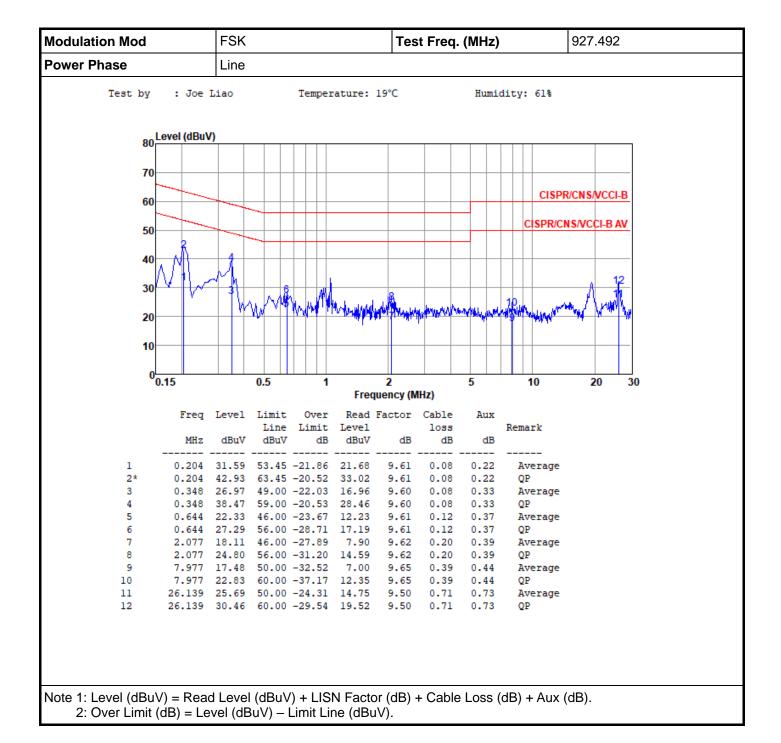
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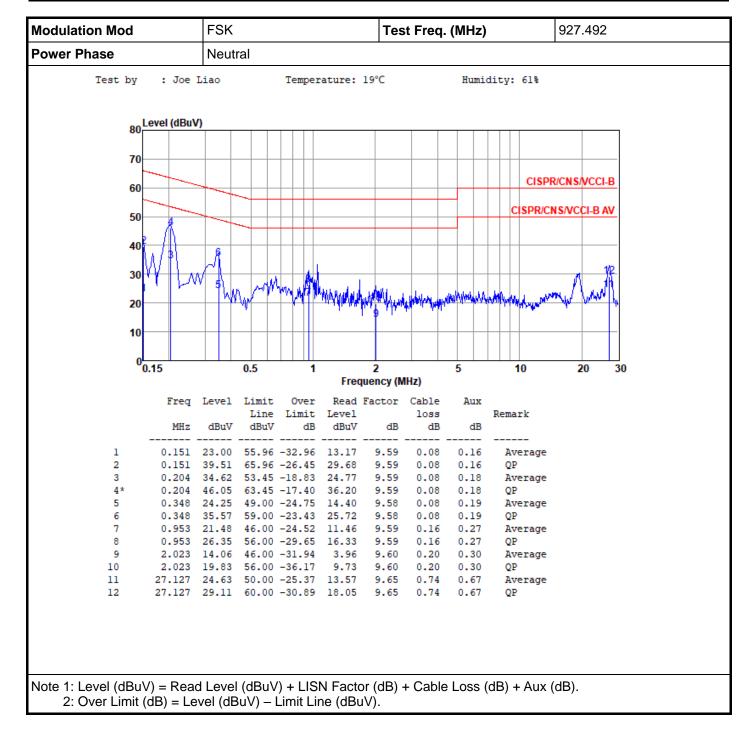
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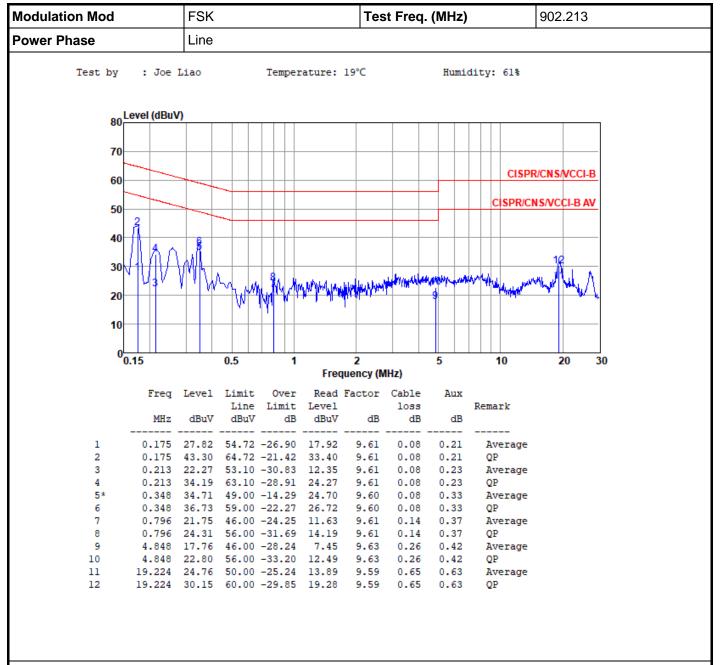
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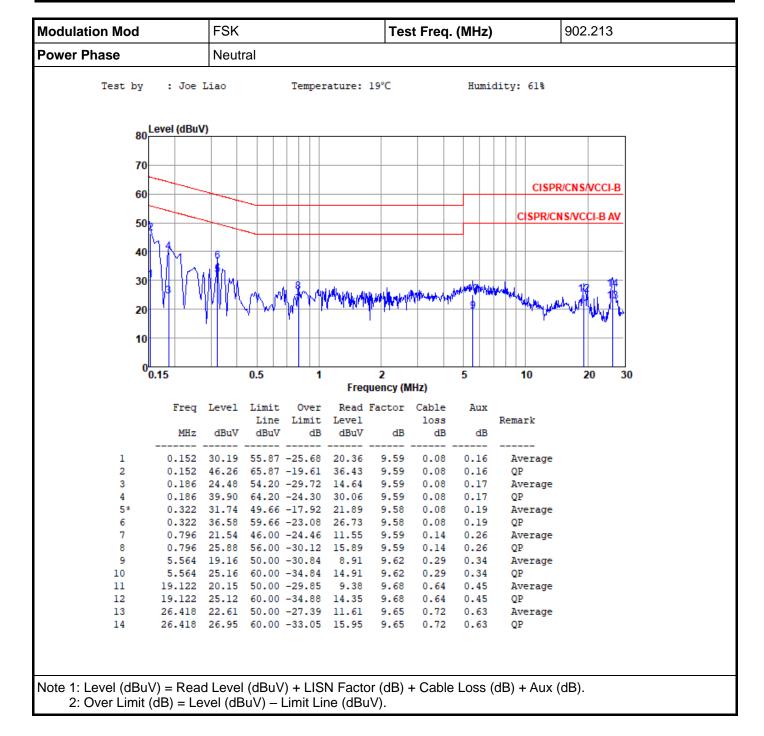
### Model: CL4490-1000-PRO



Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB) + Aux (dB).

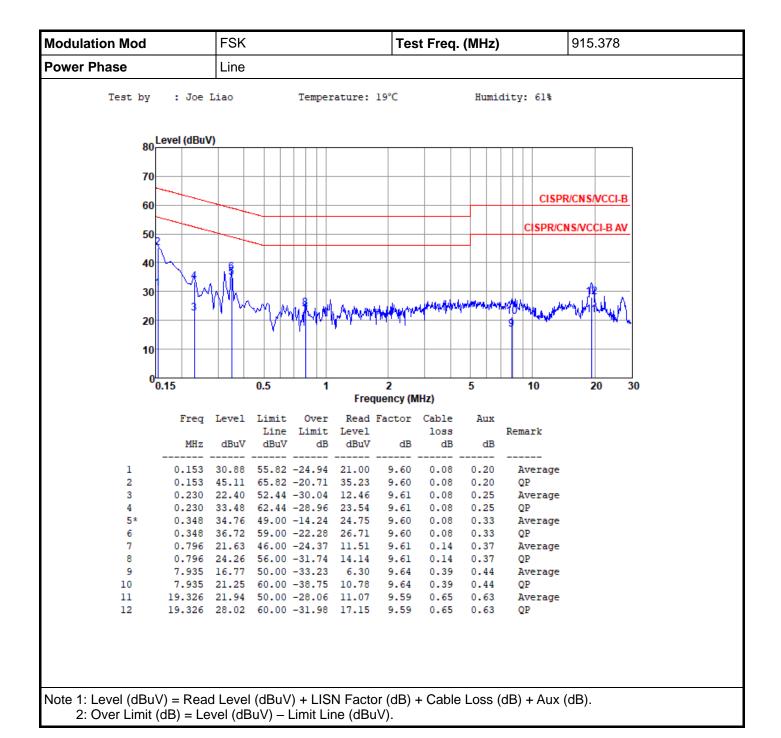
2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).





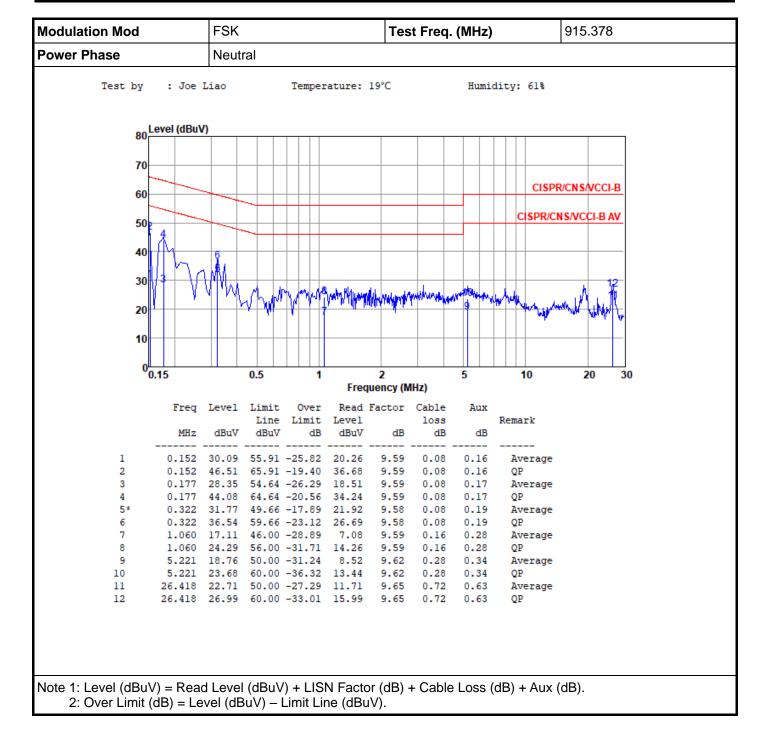
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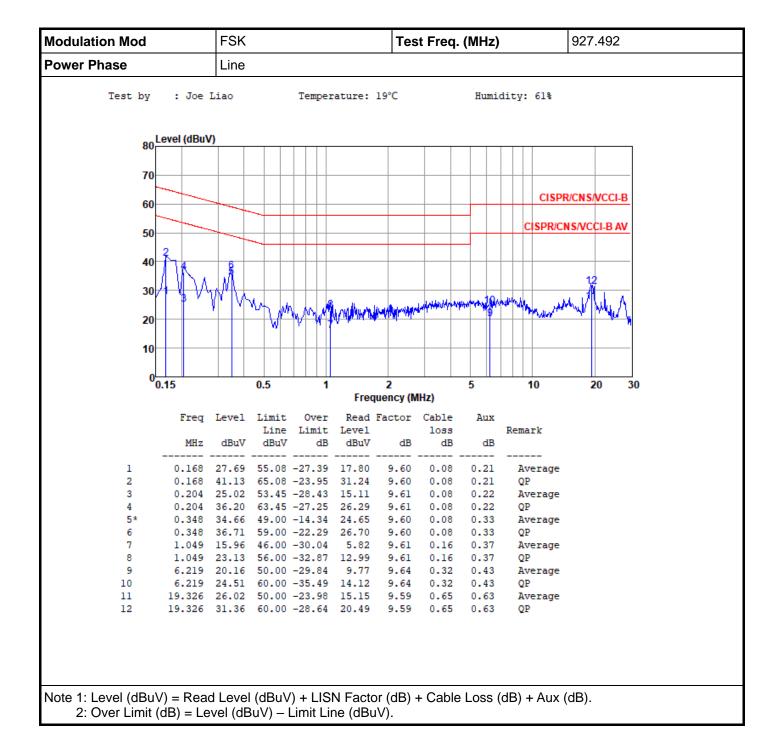
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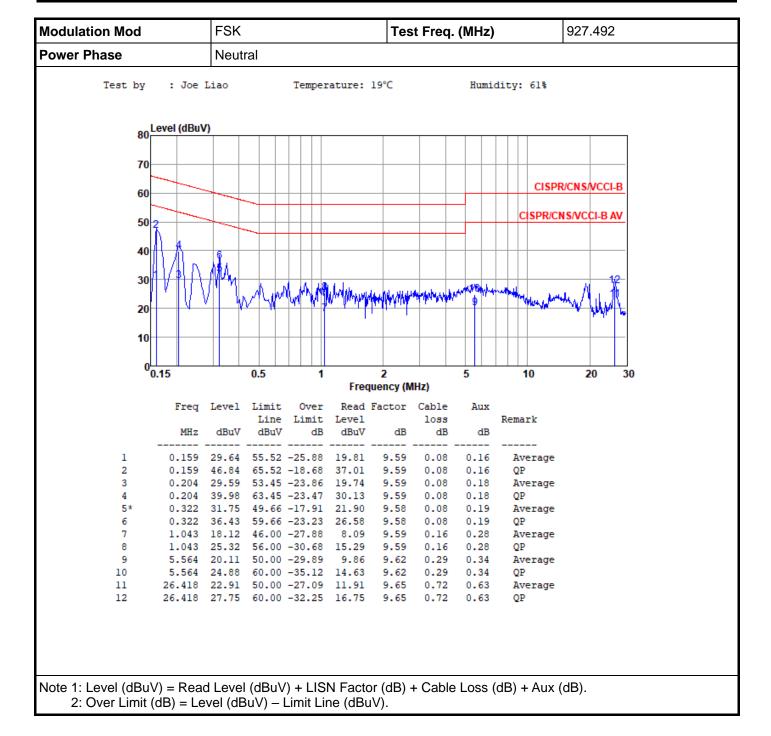
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