

FCC PART 15.249 TEST REPORT

For

FrSky Electronic Co., Ltd.

F-4, Building C, Zhongxiu Technology Park, No.3 Yuanxi Road, Wuxi, 214125, Jiangsu, China

FCC ID: XYFV5825T

Report Type:		Product Type:
Original Report		5.8G AV Transmitter
Test Engineer:	Max Min	Max Min
Report Number:	RSHA1711160	01-00A
Report Date:	2017-12-19	
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant	FrSky Electronic Co., Ltd.
Tested Model	VS025
Series Model	VS600, VS025T, VS600T, VSX00T
Model Difference	Model names
Product Type	5.8G AV Transmitter
Dimension	$20 \text{ mm(L)} \times 30 \text{ mm(W)} \times 20 \text{ mm(H)}$
Power Supply	DC 5V from DC source

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All measurement and test data in this report was gathered from production sample serial number: 20171116001. (Assigned by BACL, Kunshan). The EUT was received on 2017-11-16.

Objective

This type approval report is prepared on behalf of FrSky Electronic Co., Ltd. in accordance with Part 2-Subpart J, and Part 15-Subparts A and C of the Federal Communication Commissions rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.209 and 15.249 rules.

Related Submittal(s)/Grant(s)

N/A

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Lab Corp. (Kunshan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

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Measurement Uncertainty

Item		Uncertainty	
AC Power Line	es Conducted Emissions	3.19 dB	
RF conducte	ed test with spectrum	0.9dB	
RF Output Po	wer with Power meter	0.5dB	
	30MHz~1GHz	6.11dB	
D 11 (1	1GHz~6GHz	4.45dB	
Radiated emission	6GHz~18GHz	5.23dB	
	18GHz-40GHz	5.65dB	
Occupied Bandwidth		0.5kHz	
Temperature		1.0℃	
]	Humidity	6%	

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Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China.

Bay Area Compliance Laboratories Corp. (Kunshan) Lab is accredited to ISO/IEC 17025 by A2LA (Lab code: 4323.01) and the FCC designation No. CN1185 under the FCC KDB 974614 D01. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

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SYSTEM TEST CONFIGURATION

Justification

Channel list

Channel	Frequency (MHz)	Channel	Frequency (MHz)		
1	5732	14	5805		
2	5733	15	5806		
3	5740	16	5809		
4	5745	17	5820		
5	5752	18	5825		
6	5760	19	5828		
7	5765	20	5840		
8	5769	21	5843		
9	5771	22	5845		
10	5780	23	5847		
11	5785	24	5860		
12	5790	25	5865		
13	5800	26	5866		

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EUT was tested with channel 1, 14 and 26.

EUT Exercise Software

No software was used during the test.

Support Equipment List and Details

Manufacturer	Description	Model	Serial Number	
BEST	DC Power Supply	PS-1502D+	/	

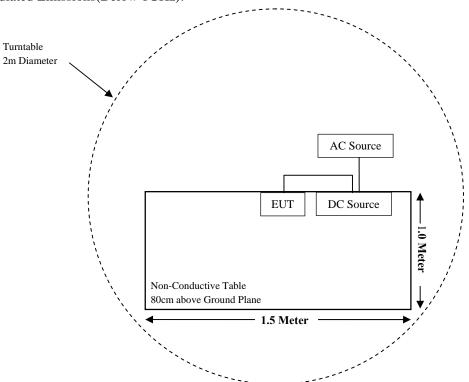
External I/O Cable

Cable Description	Shielding Type	Length (m)	From Port	То
/	/	/	/	/

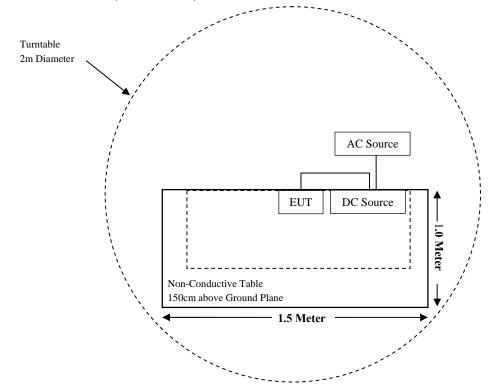
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Block Diagram of Test Setup

For Radiated Emissions(Below 1GHz):



For Radiated Emissions(Above 1GHz):



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SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliance
§15.207(a)	Conduction Emissions	Compliance
15.205, §15.209, §15.249	Radiated Emissions& Out of Band Emission	Compliance
§15.215 (c)	20 dB Bandwidth	Compliance

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TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date			
Radiated Emission Test (Chamber 1#)								
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2017-11-25	2018-11-24			
Sunol Sciences	Broadband Antenna	JB3	A040914-2	2016-01-09	2019-01-08			
Sonoma Instrunent	Pre-amplifier	310N	171205	2017-08-15	2018-08-14			
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/			
MICRO-COAX	Coaxial Cable	Cable-8	008	2017-08-15	2018-08-14			
MICRO-COAX	Coaxial Cable	Cable-9	009	2017-08-15	2018-08-14			
MICRO-COAX	Coaxial Cable	Cable-10	010	2017-08-15	2018-08-14			
BEST	DC Power Supply	PS-1502D+	/	2017-10-10	2018-10-09			
	Radiated Em	ission Test (Chan	nber 2#)					
Rohde & Schwarz	EMI Test Receiver	ESU40	100207	2017-08-27	2018-08-26			
ETS-LINDGREN	Horn Antenna	3115	6229	2016-01-11	2019-01-10			
ETS-LINDGREN	Horn Antenna	3116	00084159	2016-10-18	2019-10-17			
Narda	Pre-amplifier	AFS42- 00101800	2001270	2017-12-12	2018-12-11			
Heatsink Required	Amplifier	QLW- 18405536-J0	15964001009	2017-12-12	2018-12-11			
MICRO-TRONICS	Band Reject Filter	BRC50705	G085	2017-08-05	2018-08-04			
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/			
MICRO-COAX	Coaxial Cable	Cable-6	006	2017-08-15	2018-08-14			
MICRO-COAX	Coaxial Cable	Cable-11	011	2017-08-15	2018-08-14			
MICRO-COAX	Coaxial Cable	Cable-12	012	2017-08-15	2018-08-14			
MICRO-COAX	Coaxial Cable	Cable-13	013	2017-08-15	2018-08-14			
BEST	DC Power Supply	PS-1502D+	/	2017-10-10	2018-10-09			
	RI	F Conducted Test						
Rohde & Schwarz	Signal Analyzer	FSIQ26	836131/009	2017-09-21	2018-09-20			
Picosecond	DC Block	5500A-110	131047	2017-09-23	2018-09-22			
FrSky	RF Cable	N/A	N/A	2017-08-28	2018-08-37			
BEST	DC Power Supply	PS-1502D+	/	2017-10-10	2018-10-09			
	Conducted Emission Test							
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2017-11-12	2018-11-11			
Rohde & Schwarz	LISN	ESH3-Z5	862770/011	2017-11-12	2018-11-11			
Rohde & Schwarz	LISN	ENV216	3560655016	2017-11-12	2018-11-11			
BACL	BACL-EMC	V1.0	CE001	/	/			
Narda	Attenuator/6dB	10690812-2	26850-6	2017-01-10	2018-01-09			
MICRO-COAX	Coaxial Cable	Cable-15	015	2017-08-15	2018-08-14			

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^{*} Statement of Traceability: Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC§15.203 - ANTENNA REQUIREMENT

Applicable Standard

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used.

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Antenna Connector Construction

The EUT has a monopole antenna arrangement and antenna gain is 2dBi, which was permanently attached ,fulfill the requirement of this section, please refer to the EUT photos.

Result: Compliant.

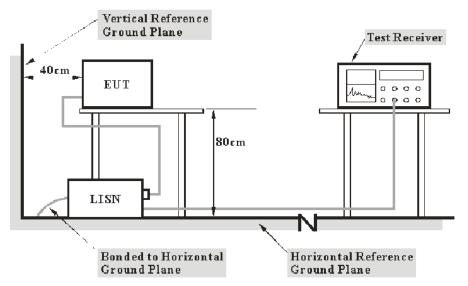
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FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207

EUT Setup



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

2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W		
150 kHz – 30 MHz	9 kHz		

Test Procedure

During the conducted emission test, the adapter was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

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Corrected Factor & Margin Calculation

The Corrected factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

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Correction Factor = LISN VDF + Cable Loss

The "Margin" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

Margin = Limit –Reading

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207.

Test Data

Environmental Conditions

Temperature:	24.2℃		
Relative Humidity:	51 %		
ATM Pressure:	101.2 kPa		

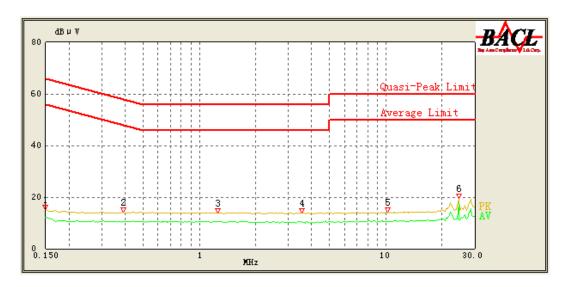
The testing was performed by Max min on 2017-12-16

EUT operation mode: Transmitting in High channel

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AC 120V/60 Hz, Line

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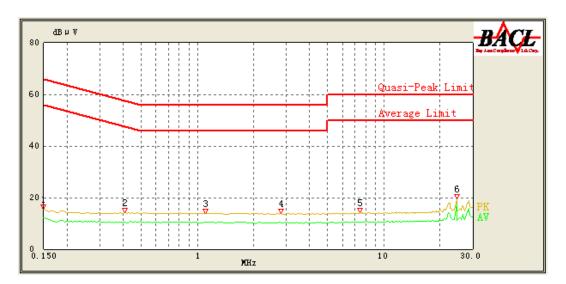


Frequency (MHz)	Reading (dBμV)	Detector (PK/AV/QP)	Bandwidth (kHz)	Line	Corr. (dB)	Limit (dBµV)	Margin (dB)	Comment
0.150	15.22	PK	9.000	L1	16.06	66.00	50.78	Compliance
0.150	12.30	AV	9.000	L1	16.06	56.00	43.70	Compliance
0.390	14.07	PK	9.000	L1	16.05	59.14	45.07	Compliance
0.390	10.49	AV	9.000	L1	16.05	49.14	38.65	Compliance
1.250	13.94	PK	9.000	L1	15.87	56.00	42.06	Compliance
1.250	10.38	AV	9.000	L1	15.87	46.00	35.62	Compliance
3.550	13.84	PK	9.000	L1	15.85	56.00	42.16	Compliance
3.550	10.34	AV	9.000	L1	15.85	46.00	35.66	Compliance
10.250	14.09	PK	9.000	L1	16.07	60.00	45.91	Compliance
10.200	10.40	AV	9.000	L1	16.07	50.00	39.60	Compliance
24.550	19.65	PK	9.000	L1	16.46	60.00	40.35	Compliance
24.550	17.48	AV	9.000	L1	16.46	50.00	32.52	Compliance

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AC 120V/60 Hz, Neutral

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Frequency (MHz)	Reading (dBμV)	Detector (PK/AV/QP)	Bandwidth (kHz)	Line	Corr. (dB)	Limit (dBµV)	Margin (dB)	Comment
0.150	15.44	PK	9.000	N	16.06	66.00	50.56	Compliance
0.150	12.23	AV	9.000	N	16.06	56.00	43.77	Compliance
0.410	14.10	PK	9.000	N	16.06	58.57	44.47	Compliance
0.410	10.66	AV	9.000	N	16.06	48.57	37.91	Compliance
1.100	13.95	PK	9.000	N	15.88	56.00	42.05	Compliance
1.100	10.56	AV	9.000	N	15.88	46.00	35.44	Compliance
2.800	13.71	PK	9.000	N	15.85	56.00	42.29	Compliance
2.800	10.10	AV	9.000	N	15.85	46.00	35.90	Compliance
7.450	14.13	PK	9.000	N	15.99	60.00	45.87	Compliance
7.400	10.59	AV	9.000	N	15.99	50.00	39.41	Compliance
24.550	19.59	PK	9.000	N	16.46	60.00	40.41	Compliance
24.550	17.40	AV	9.000	N	16.46	50.00	32.60	Compliance

1) Corr.=LISN VDF (Voltage Division Factor) + Cable Loss 2) Margin = Limit – Reading

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FCC§15.205, §15.209&§15.249- RADIATED EMISSIONS& OUT OF BAND EMISSION

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Applicable Standard

As per FCC§15.249 (a), except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

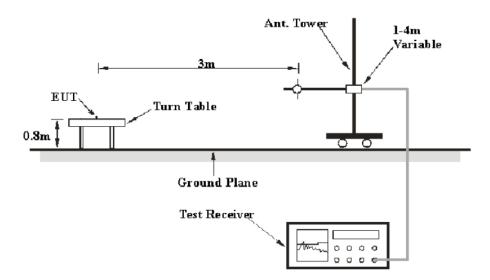
Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

As per FCC§15.249 (c), Field strength limits are specified at a distance of 3 meters.

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

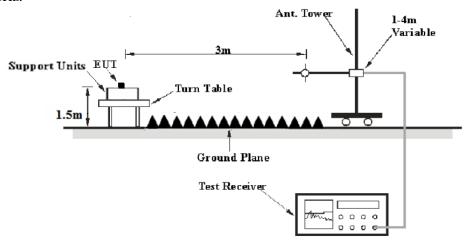
EUT Setup

Below 1 GHz:

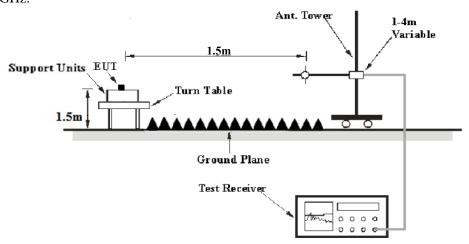


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1 GHz-18GHz:



18 GHz-40GHz:



The radiated emission and out of band emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209/15.205 and FCC 15.249 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

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Test Equipment Setup

The system was investigated from 30 MHz to 40 GHz.

During the radiated emission test, the EMI test receiver were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP
Alexand CH-	1MHz	3 MHz	/	PK
Above 1GHz	1MHz	3 MHz	/	Ave

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Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

All data was recorded in the Quasi-peak detection mode from 30MHz to 1GHz, Peak and average detection mode above 1 GHz.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Corrected Amplitude = Meter Reading + Antenna Factor + Cable Loss - Amplifier Gain

The "Margin" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin = Limit –Corrected Amplitude

Test Results Summary

According to the data in the following table, the EUT complied with the FCC Part 15.209 &15.205 & 15.249.

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Test Data

Environmental Conditions

Temperature:	24.6°C
Relative Humidity:	52%
ATM Pressure:	101.2 kPa

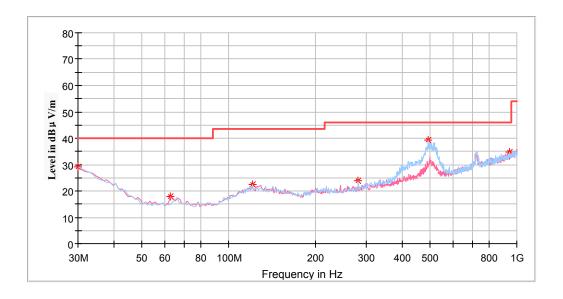
The testing was performed by Max Min on $2017-12-12 \sim 2017-12-19$.

Test Mode: Transmitting

30MHz-1GHz

(Pre-scan with low, middle, high channels of operation in the X,Y and Z axes of orientation, the worst case **high** channel of operation in the X-axis of orientation was recorded)

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Frequency	Corrected Amplitude	Rx Antenna		Turntable	Corr.	Limit	Margin
(MHz)	QuasiPeak (dB µ V/m)	Height (cm)	Polar (H/V)	Degree	(dB/m)	(dBµV/m)	(dB)
30.000000	28.95	200.0	Н	85.0	-4.4	40.00	11.05
62.980000	17.73	100.0	V	126.0	-18.2	40.00	22.27
121.180000	22.52	200.0	Н	171.0	-11.7	43.50	20.98
281.230000	23.77	100.0	Н	74.0	-11.6	46.00	22.23
492.690000	39.45	200.0	Н	212.0	-6.3	46.00	6.55
945.680000	34.90	100.0	Н	170.0	1.1	46.00	11.10

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Spurious Emissions:

1GHz - 18GHz

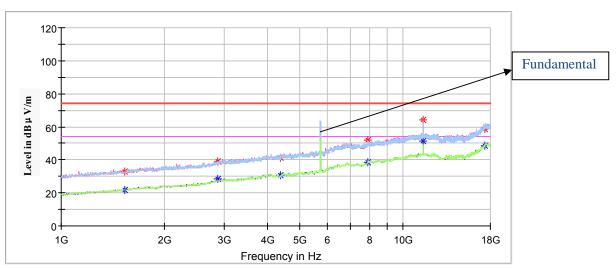
(Pre-scan in the X,Y and Z axes of orientation, the worst case in the **X-axis of orientation** was recorded)

Note:

- 1. This test was performed with the 5.725-5.875GHz band reject filter.
- 2. Corrected Factor = Antenna factor (RX) + Cable Loss Amplifier Factor Corrected Amplitude = Corrected Factor + Reading Margin = Limit Corrected. Amplitude

Low Channel: 5732MHz





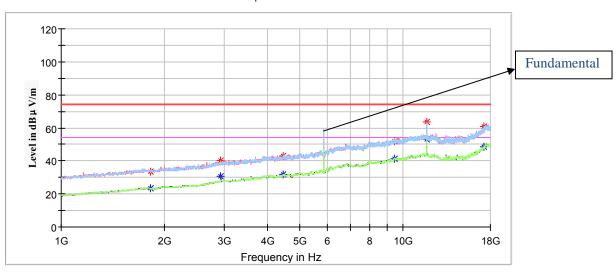
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Frequency	Corrected .	Amplitude	Rx A	Rx Antenna		Corr.	Limit	Margin
(MHz)	MaxPeak (dBμV/m)	Average (dBµV/m)	Height (cm)	Polar (H/V)	Turntable Degree	(dB/m)	(dBµV/m)	(dB)
1533.800000		21.75	250.0	V	132.0	-7.9	54.00	32.25
1533.800000	32.85		250.0	V	132.0	-7.9	74.00	41.15
2866.600000		28.59	150.0	V	0.0	-2.7	54.00	25.41
2866.600000	39.32		150.0	V	0.0	-2.7	74.00	34.68
4386.400000		30.65	150.0	V	35.0	1.6	54.00	23.35
4386.400000	41.16		150.0	V	35.0	1.6	74.00	32.84
7905.400000		38.77	250.0	V	3.0	11.7	54.00	15.23
7905.400000	52.13		250.0	V	3.0	11.7	74.00	21.87
11464.000000		50.31	250.0	V	57.0	18.2	54.00	3.69
11464.000000	63.91		250.0	V	57.0	18.2	74.00	10.09
17196.000000		48.69	200.0	Н	132.0	21.7	54.00	5.31
17196.000000	58.70		200.0	Н	132.0	21.7	74.00	15.30

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Middle Channel: 5805MHz

Full Spectrum



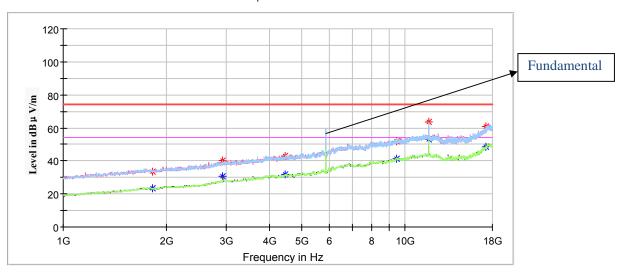
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Frequency	Corrected A	Amplitude	Rx A	ntenna	Turntable		Limit	Margin
(MHz)	MaxPeak (dBμV/m)	Average (dBµV/m)	Height (cm)	Polar (H/V)	Degree	Corr. (dB/m)	(dBµV/m)	(dB)
2016.600000	36.89		250.0	V	247.0	-6.0	74.00	37.11
2016.600000		23.99	250.0	V	247.0	-6.0	54.00	30.01
2900.600000		30.11	150.0	Н	57.0	-2.5	54.00	23.89
2900.600000	40.42		150.0	Н	57.0	-2.5	74.00	33.58
4291.200000	41.99		200.0	V	57.0	1.4	74.00	32.01
4291.200000		30.49	200.0	V	57.0	1.4	54.00	23.51
6865.000000	51.06		250.0	V	114.0	9.2	74.00	22.94
6865.000000		37.76	250.0	V	114.0	9.2	54.00	16.24
11610.000000	62.71		250.0	V	56.0	17.9	74.00	11.29
11610.000000		51.14	250.0	V	56.0	17.9	54.00	2.86
17415.000000	56.92		150.0	V	132.0	22.9	74.00	17.08
17415.000000		45.68	150.0	V	132.0	22.9	54.00	8.32

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High Channel: 5866MHz

Full Spectrum



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Frequency	Corrected A	Amplitude	Rx A	ntenna	Turntable	Corr.	Limit	Margin
(MHz)	MaxPeak (dBμV/m)	Average (dBµV/m)	Height (cm)	Polar (H/V)	Degree	(dB/m)	(dBµV/m)	(dB)
1826.200000	33.36		250.0	V	136.0	-6.7	74.00	40.64
1826.200000		23.42	250.0	V	136.0	-6.7	54.00	30.58
2931.200000		30.67	150.0	Н	180.0	-2.4	54.00	23.33
2931.200000	40.15		150.0	Н	180.0	-2.4	74.00	33.85
4457.800000	42.97		200.0	V	136.0	1.7	74.00	31.03
4457.800000		31.77	200.0	V	136.0	1.7	54.00	22.23
9442.200000	51.84		250.0	V	226.0	14.7	74.00	22.16
9442.200000		41.26	250.0	V	226.0	14.7	54.00	12.74
11732.000000		51.26	250.0	V	221.0	17.4	54.00	2.74
11732.000000	63.37		250.0	V	221.0	17.4	74.00	10.63
17598.000000		48.78	150.0	V	47.0	23.9	54.00	5.22
17598.000000	60.63		150.0	V	47.0	23.9	74.00	13.37

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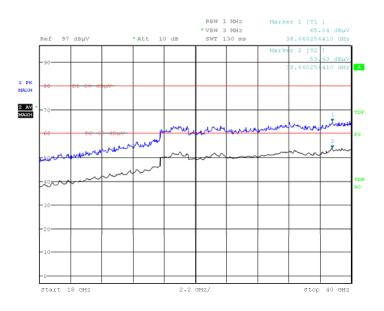
18GHz-40GHz

(Pre-scan with low, middle, high channels of operation in the X,Y and Z axes of orientation, the worst case **high** channel of operation in the X-axis of orientation was recorded)

Note: The test distance is 1.5m, The limit is 74dBuv/m@3m + 20*log(3/1.5) = 80 dBuv/m@1.5m

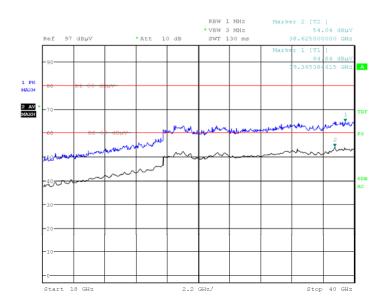
Horizontal Plot

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Date: 19.DEC.2017 11:01:52

Vertical Plot



Date: 19.DEC.2017 11:02:17

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Fundamental Test:

(Pre-scan in the X,Y and Z axes of orientation, the worst case in the **X-axis of orientation** was recorded)

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Note:

- 1. Corrected Factor = Antenna factor (RX) + Cable Loss Amplifier Factor
- 2. Corrected Amplitude = Corrected Factor + Reading
- 3. Margin = Limit Corrected. Amplitude

Frequency	Corrected .	Amplitude	Rx A	ntenna	Turntable	Corr.	Limit	Margin
(MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Height (cm)	Polar (H/V)	Degree	(dB/m)	(dBµV/m)	(dB)
5732	99.34		150	V	224	4.8	114	14.66
5732		88.51	150	V	224	4.8	94	5.49
5732	94.69		200	Н	178	4.8	114	19.31
5732		83.55	200	Н	178	4.8	94	10.45
5805	98.14		150	V	156	5.0	114	15.86
5805		87.46	150	V	156	5.0	94	6.54
5805	94.57		200	Н	23	5.0	114	19.43
5805		83.71	200	Н	23	5.0	94	10.29
5866	98.71		150	V	198	5.3	114	15.29
5866		87.34	150	V	198	5.3	94	6.66
5866	93.87		200	Н	123	5.3	114	20.13
5866		82.74	200	Н	123	5.3	94	11.26

Band Edges Emissions:

(Pre-scan in the X,Y and Z axes of orientation, the worst case in the **X-axis of orientation** was recorded)

Note

- $1.\ Corrected\ Factor = Antenna\ factor\ (RX) + Cable\ Loss Amplifier\ Factor$
- 2. Corrected Amplitude = Corrected Factor + Reading
- 3. Margin = Limit Corrected. Amplitude

Frequency	Corrected	l Amplitude	Rx A	ntenna	Turntable	Corr.	Limit	Margin
(MHz)	MaxPeak (dBμV/m)	Average (dBµV/m)	Height (cm)	Polar (H/V)	Degree	(dB/m)	(dBµV/m)	(dB)
	Left Band Edge							
5725	56.43		150	V	100	4.8	74	17.57
5725		45.71	150	V	100	4.8	54	8.29
			Right Ba	and Edge				
5875	57.31		150	V	0	5.3	74	16.69
5875		46.51	150	V	0	5.3	54	7.49

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FCC §15.215(c) – 20 dB BANDWIDTH TESTING

Applicable Standard

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §15.217 through §15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

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Test Procedure

- 1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- 2. Position the EUT on the test table without connection to measurement instrument. Turn on the EUT. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- 3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
- 4. Repeat above procedures until all frequencies measured were complete.

Test Data

Environmental Conditions

Temperature:	24.2°C
Relative Humidity:	51 %
ATM Pressure:	101.2kPa

The testing was performed by Max Min on 2017-11-30 \sim 2017-12-16.

Test Result: Compliant.

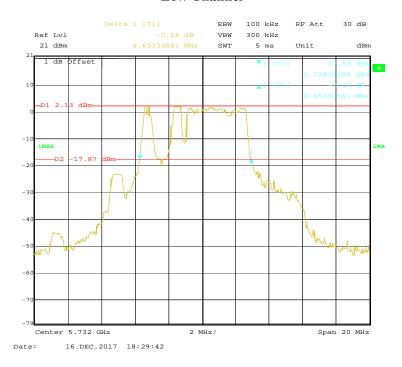
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Test Mode: Transmitting

Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
Low	5732	6.65
Middle	5805	6.45
High	5866	6.69

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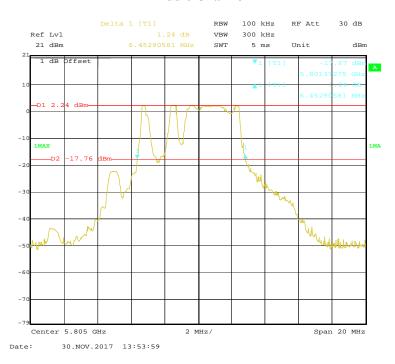
Low Channel



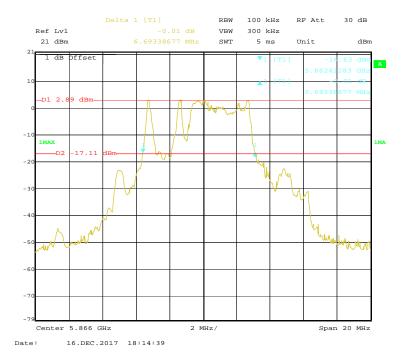
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Middle Channel

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High Channel



***** END OF REPORT *****

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