

From: Johnny Stigler Jstigler@swbell.net  
Subject: RE: TVWS Massive MIMO  
Date: May 22, 2020 at 4:53 PM  
To: Camp, Joseph camp@lyle.smu.edu



Joe & I have spoken about his MIMO drone project.  
I recommend the following in the TV Spectrum after repack:  
Ch15 476-482MHz  
Ch17 488-494MHz  
Ch28 554-560MHz back up as a LP Digital may show up  
Johnny Stigler  
SBE 67 Freq Coord  
214-236-0222

Hi Mr. Stigler,

I talked to Skylark Wireless (<https://www.skylarkwireless.com>) and they gave me a link model to see what ERP their hardware would output. With 16 radios operating at 26 dBm, the maximum EIRP would be 50 dBm or 100 W. Please see the calculation below:

Massive MIMO Link Budget	Params	Down	Up	Notes
Per Radio Power	26 dBm			Assumes PAPR included
Number of Radios		16		
Number of Spatial Streams		16		
Polarization		2		Polarizations Beamform in Isolation, but splits number of spatial streams across them
Carrier Frequency	500 MHz			
Distance	5 miles			
Freespace Pathloss	104.48 dB			
Antenna Gain		15 dB	5 dB	Includes any cable/connector loss
<b>Max Achievable EIRP</b>		<b>50 dBm</b>	<b>31 dBm</b>	<b>Per spatial stream in downlink</b>
EIRP Limit (Regulatory)		100 dBm	100 dBm	Set this very high if there is no regulatory limit (for channel estimates on uplink -- though using narrowband channel estimates avoids PAPR loss and would improve this)
Receive Power		-49 dBm	-58.48 dBm	(after array combining on uplink)
			-49.45 dBm	

Would this be something we could do on channel 15, 17, 26, or 28? We only need one channel.

-Joe

Joseph Camp, 6251 Airline #340, Dallas, TX 75205-2333,  
NAME  
(Nature of Service)  
(Class of Station)  
(Call Sign)  
(File Number) 0288-EX-RR-2015

Subject to the provisions of the Communications Act of 1934, subsequent acts, and treaties, and all regulations heretofore or hereafter made by this Commission, and further subject to the conditions and requirements set forth in this license, the licensee hereof is hereby authorized to use and operate the radio transmitting facilities hereinafter described for radio communications in accordance with the program of experimentation described by the licensee in its application for license. Operation: In accordance with Sec. 5.3(j) of the Commission's Rules

XD

RADIO STATION CONSTRUCTION PERMIT

United States of America FEDERAL COMMUNICATIONS COMMISSION EXPERIMENTAL

WF2XUJ

FX MO

EXPERIMENTAL

AND LICENSE

Station Locations Dallas (DALLAS), TX - NL 32-50-31; WL 96-46-38; MOBILE: Dallas, Texas - SMU Campus, within 50 km, centered around NL 32-50-31; WL 96-46-38 (1) Frequency Information  
Dallas (DALLAS), TX - NL 32-50-31; WL 96-46-38; MOBILE: Dallas, Texas - SMU Campus, within 50 km, centered around NL

Frequency

Station Class

Emission Designator

Authorized Power

Frequency Tolerance (+/-) 450-460 MHz MO 2.9 W (ERP) 100MD3D

450-460 MHz FX 2.9 W (ERP) 100MD3D

470-608 MHz FX 2.9 W (ERP) 100MD3D

470-608 MHz MO 2.9 W (ERP) 100MD3D

Southern Methodist University

and

COMMISSION

FEDERAL COMMUNICATIONS

Page 1 of 4

August 01, 2015 will expire 3:00 A.M. EST August 01, 2020 This authorization effective

Licensee Name: Southern Methodist University

File Number: 0288-EX-RR-2015 Call Sign: WF2XUJ Frequency

Information

Dallas (DALLAS), TX - NL 32-50-31; WL 96-46-38; MOBILE: Dallas, Texas - SMU Campus, within 50 km, centered around NL

Frequency

Station Class

Emission Designator

Authorized Power

Frequency Tolerance (+/-) 690-810 MHz FX 2.9 W (ERP) 40M0D3D

690-810 MHz MO 2.9 W (ERP) 40M0D3D

790-890 MHz FX 2.9 W (ERP) 40M0D3D

790-890 MHz MO 2.9 W (ERP) 40M0D3D

890-960 MHz FX 2.9 W (ERP) 40M0D3D

890-960 MHz MO 2.9 W (ERP) 40M0D3D

890-930 MHz FX 2.9 W (ERP) 40M0D3D

890-930 MHz MO 2.9 W (ERP) 40M0D3D

2412-2500 MHz FX 2.9 W (ERP) 40M0D3D

2412-2500 MHz MO 2.9 W (ERP) 40M0D3D

Page 2 of 4

Licensee Name: Southern Methodist University

File Number: 0288-EX-RR-2015 Call Sign: WF2XUJ

Special Conditions: (1) Operation is subject to prior coordination with the Society of Broadcast Engineers, Inc. (SBE); ATTN: Executive Director; 9102 North Meridian Street, Suite 305; Indianapolis, IN 46260; telephone, (866) 632-4222; FAX, (317) 846-9120; e-mail, [executivedir@sbe.org](mailto:executivedir@sbe.org); information, [www.sbe.org](http://www.sbe.org). (2) In lieu of frequency tolerance, the occupied bandwidth of the emission shall not extend beyond the band limits set forth above. (3) The station identification requirements of Section 5.115 of the Commission's Rules are waived. (4) Licensee should be aware that other stations may be licensed on these frequencies and if any interference occurs, the licensee of this authorization will be subject to immediate shut down. (5) No operation is PERMITTED to transmit in any public safety frequencies listed under Part 90.20. (6) Operation is subject to prior coordination with affected existing Fixed Microwave Service licensees. (7) The designated point-of-contact to terminate transmissions if interference occurs is Mr. Joseph Camp at 214-768-8541.

Frequency Information

Dallas (DALLAS), TX - NL 32-50-31; WL 96-46-38; MOBILE: Dallas, Texas - SMU Campus, within 50 km, centered around NL

Frequency

Station Class

Emission Designator

Authorized Power

Frequency Tolerance (+/-) 4940-4990 MHz FX 2.9 W (ERP) 40M0D3D

4940-4990 MHz MO 2.9 W (ERP) 40M0D3D

5300-5600 MHz MO 2.9 W (ERP) 40M0D3D

5300-5600 MHz FX 2.9 W (ERP) 40M0D3D

5650-6100 MHz MO 2.9 W (ERP) 40M0D3D

5650-6100 MHz FX 2.9 W (ERP) 40M0D3D

Page 3 of 4

Licensee Name: Southern Methodist University

File Number: 0288-EX-RR-2015 Call Sign: WF2XUJ Special

Conditions: (8) Licensee is authorized to up 50 units per test.

Page 4 of 4

214-236-0222

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**From:** Camp, Joseph [mailto:camp@lyle.smu.edu]  
**Sent:** Friday, May 22, 2020 3:15 PM  
**To:** jstigler@swbell.net  
**Subject:** TVWS Massive MIMO

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Joseph Camp  
Associate Professor, SMU  
Lyle School of Engineering (ECE)  
<http://lyle.smu.edu/~camp>