









NO CLU

Communication modes I've tried with satellites

- 1. APRS with the ISS
- 2. SSTV with the ISS
- 3. FM 2m/70cm with SO-50, AO-91, ISS, .....

### Communication modes I've not tried with satellites 1. CW

2. Telemetry and Weather/Radar Images





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#### http://www.w3pga.org/APRS.htm

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ISS amateur radio capabilities include a voice repeater, digital packet radio (APRS) capabilities and a Kenwood VC-H1 slow scan television (SSTV) system.

The radio in the Columbus module is a "space-modified" JVC Kenwood D710GA transceiver

The FM cross band repeater mode uses an uplink frequency of 145.990 MHz with an access tone of 67 Hz and a downlink frequency of 437.800 MHz



Automatic Packet Reporting System 144.390 MHz APRS path = WIDE2-1, WIDE1-1

The ISS PM3 packet mode (APRS) employs a downlink frequency of 145.825 MHz APRS path = ARISS

A terminal node controller (TNC) is a device used by amateur radio operators to participate in AX. 25 packet radio networks. It is similar in function to the Packet Assembler/Disassemblers used on X. 25 networks, with the addition of a modem to convert baseband digital signals to audio tones.

A **digipeater** is a digital repeater. The **digipeater** listens for data chirps that have been encoded with instructions to retransmit them and then retransmits what it hears when appropriate. This allows users with mobile or portable **APRS** stations to cover a wider geographic area.

Slow-scan television (**SSTV**) is a picture transmission method, used mainly by amateur radio operators, to transmit and receive static pictures via radio in monochrome or color. A literal term for **SSTV** is narrowband television.



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#### **Antennas For Satellite Communications**







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# Satellite Tracking

# Software

http://www.amsat.org.ar/pass.htm https://www.n2yo.com/ http://www.stoff.pl/

#### Ground track









Date (UTC)	AOS (UTC)	Duration	AOS Azimuth	Maximum Elevation	Max El Azimuth	LOS Azimuth	LOS (UTC)	
14 Apr 21	12:59:24	00:07:22	169	6	127	83	13:06:46	
14 Apr 21	14:33:48	00:10:52	224	58	132	58	14:44:40	
14 Apr 21	16:11:01	00:10:22	266	25	322	51	16:21:23	
14 Apr 21	17:49:04	00:09:41	297	15	357	61	17:58:45	
14 Apr 21	19:26:26	00:10:25	308	23	6	91	19:36:51	
14 Apr 21	21:03:15	00:10:49	303	71	216	132	21:14:04	
14 Apr 21	22:40:55	00:08:01	281	8	240	185	22:48:56	
15 Apr 21	12:13:49	00:04:23	146	2	120	98	12:18:12	
15 Apr 21	13:46:41	00:10:34	212	32	120	62	13:57:15	
15 Apr 21	15:23:25	00:10:42	257	33	349	52	15:34:07	

#### Google Maps https://aprs.fi/

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APRS station M	(D9QOG W - show graphs
Comment:	Greetings/ From South Bend Indiana
Location:	41°35.86' N 86°14.41' W - locator EN61V013EK - show map - static map 1.1 miles South bearing 166° from Gulivoire Park, Saint Joseph County, Indiana, United States [7] 5.9 miles South bearing 175° from South Bend, Saint Joseph County, Indiana, United States 6.1 miles Southwest bearing 223° from Mishawaka, Saint Joseph County, Indiana, United States 66.0 miles Northwest bearing 300° from Fort Wayne, Allen County, Indiana, United States
Last position:	2021-04-13 19:27:26 CDT (12h22m ago) 2021-04-13 20:27:26 EDT local time at Gulivoire Park, United States [?]
Altitude:	863 ft
Course:	0.0
Speed:	0 MPH
Device:	unknown: D-Star APDPRS (D-Star)
Last path:	KD9QOG>APDPRS via DSTAR*,qAR,KD9QOG-C Good path!
Positions stored	: 169
Other SSIDs:	KD9QOG-C

#### Stations near current position of KD9QOG - show more

callsign di	istance	last heard - CDT	callsign	distance	last heard -	CDT
KD9QOG C 🐽 0	.0 yards 0°	2021-04-13 19:34:36	KD9QOG-C 🛈	0.0 yards 0°	2021-04-13	19:34:36
AB9QB-14 🛤 1	2 miles 271°	2021-04-14 07:48:55	KD95FW-7 K	2.0 miles 354°	2021-03-30	22:01:17
FW9588 🚳 2	.8 miles 8º	2021-04-14 07:40:59	KEBGIM-N 🛈	3.7 miles 225°	2021-04-14	07:34:08
147.330IN 🔏 4	.1 miles 93°	2021-04-14 07:45:36	KD9EYW-7 🌧	5.5 miles 38°	2021-04-12	07:52:01
KG9QT B 🐽 5	.6 miles 28°	2021-04-04 00:44:33	KG9QT-B	5.6 miles 28¢	2021-04-04	00:44:43
NIEWO-N 05	.9 miles 39°	2021-04-14 07:30:47	N1EWO	5.9 miles 38°	2021-04-14	07:46:41
K9KJD-9 🚓 5	9 miles 28°	2021-04-14 06:04:45	KD9BNL-1	6.1 miles 46°	2021-04-14	07:47:55
KC9MEC B 🐽 6	4 miles 346°	2021-04-13 16:34:55	КС9МЕС-В	6.4 miles 346°	2021-04-13	16:35:05
CW2578 🚾 6	.7 miles 59°	2021-04-14 07:15:04	KC9MEC-N	6.7 miles 3370	2021-04-14	07:42:58
KD9QOG 🛃 6	8 miles 3°	2021-04-13 12:24:34	KO4LUV 🚺	6.9 miles 1°	2021-04-10	10:33:56
Stations which	heard KD9Q	OG directly on radio -	2021-04 ¥			
callsign pkts	sfirst heard	CDT last heard	longest	(tx	=> rx)	longest at - CDT

W9LRT-1	-	7	2021-04-01 21:21:24 2021-0	4-13 16:31:59	EN61VO > EN	61WL 10.0 miles 1569	2021-04-13 16:31:59
W9LRT-2	*	1	2021-04-13 16:27:02 2021-0	4-13 16:27:02	EN61VO > EN	61WQ 7.7 miles 48*	2021-04-13 16:27:02
NA155	床	12	2021-04-01 21:33:15 2021-0	4-13 16:56:04	EN61VO > JJ0	00CA 6028.5 miles 92°	2021-04-13 16:56:04

https://www.amsat.org/status/

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#### https://www1.findu.com/

 KD9QOG
 X
 1
 2021-03-14
 22:11:18
 EN61VO
 JJOOCA
 6028.5
 miles
 312°
 2021-03-14
 22:11:18

 KD9QOG>T1SU8V,NA1SS\*,qAR,KD8THX-6:
 r\*FI!<[/>\*6^}Greetings!
 From South Bend Indiana
 5.3
 miles
 311°
 2021-03-14
 22:10:28



#### Amateur Radio Stations heard via Satellite

00:10:34:39 : W3ADO-1]BEACON, SGATE, GAU, DH0FAA-2:T#001,040,129,069,048,216,11111111,0000,1 00:12:19:05 : W3ADO-1]BEACON, SGATE, qAU, DC8LZ-10:T#001,041,151,070,047,216,11111111,0000,1 00:12:39:06 : KE4AZZ]SPCL,PCSAT-11\*,qAR,VE3DVC-10:=2702.06N/08209.93Wy KE4AZZ EL87 00:12:42:14 : KE4AZZ CQ,W3ADO-1\*,XBAUD,qAO,W0ARP-14:=2702.06N/08209.93W-KE4AZZ e187 00:12:42:21 : KE4AZZ]SPCL,PCSAT-11\*,qAR,N6DAN-1:=2702.06N/08209.93Wy KE4AZZ EL87 00:14:03:07 : W3ADO-1]BEACON,SGATE,qAU,DL1NUX-1:T#001,047,145,070,047,216,11111111,0000,1 00:14:22:19 : KE4AZZ]SPCL,PCSAT-11\*,qAR,KG4PID-12:=2702.06N/08209.93Wy KE4AZZ EL87 00:14:23:48 : KE4AZZ]SPCL,PCSAT-11\*,qAR,KC5DR-5:=2702.06N/08209.93Wy KE4AZZ EL87 00:14:23:50 : KE4AZZ CQ,W3ADO-1\*,XBAUD,qAS,P43L-5:=2702.06N/08209.93W-KE4AZZ e187 00:14:23:53 : KE4AZZ]SPCL,PCSAT-11\*,qA5,P43L-5:=2702.06N/08209.93Wy KE4AZZ EL87 00:15:07:44 : W3ADO-1]BEACON,SGATE,qAR,VK5ATN-3:T#001,040,154,071,046,216,11111111,0000,1 00:19:17:33 : OE5RPP-1 CQ,W3ADO-1\*,qAR,ON7EQ-10:=4756.37N/01328.94E Hello to all via SAT de Peter { 00:19:17:41 : OE5RPP-1]CQ,W3ADO-1\*,qAR,ON7EQ-10:73 to all via SAT from Austria http://qsl.net/oe5rpp 00:19:19:39 : OE5RPP-1]CQ,W3ADO-1\*,qAR,ON7EQ-10:73 to all via SAT from Austria http://qsl.net/oe5rpp 00:19:20:08 : OE5RPP-1]CQ,W3ADO-1\*,qAR,ON7EQ-10:=4756.37N/01328.94E`Hello to all via SAT de Peter { 00:19:20:27 : OE5RPP]CQ,W3ADO-1\*,qAO,SQ5MJA-15:73 to all via SAT from Austria http://qsl.net/oe5rpp 00:19:22:24 : OE5RPP-1]CQ,W3ADO-1\*,qAR,ON7EQ-10:73 to all via SAT from Austria http://qsl.net/oe5rpp 00:19:22:27 : OE5RPP]CQ,W3ADO-1\*,qAR,ON7EQ-10:=4756.37N/01328.94E`Hello to all via SAT de Peter {UIS 00:20:54:38 : SV2CPH]TPQX16,W3ADO-1\*,qAR,LA3SHA-15:`1KEl D-/`efarmogigr@hotmail.com 01:03:20:11 : W3ADO-1]BEACON,SGATE,qAR,KG4PID-12:T#001,041,145,071,048,216,11111111,0000,1 01:03:22:29 : W3ADO-1]BEACON, SGATE, qAR, N6DAN-1:T#001,041,094,071,048,216,11111111,0000,1 01:06:36:44 : W3ADO-1]BEACON, SGATE, qAR, EA8BQD: T#001, 041, 135, 072, 058, 216, 11111111, 0000, 1 01:08:20:52 : W3ADO-1]BEACON, SGATE, qAR, CT1EBQ-3:T#001,041,138,071,061,216,11111111,0000,1 01:09:14:36 : W3ADO-1]BEACON, SGATE, qAR, VK2TV-4:T#001,040,150,071,047,216,11111111,0000,1 01:10:09:38 : W3ADO-1]BEACON,SGATE,qAR,2E1DWP:T#001,041,151,072,048,216,11111111,0000,1 01:11:51:18 : W3ADO-1]BEACON, SGATE, qAR, ON7EQ-10:T#001,051,131,072,048,216,11111111,0000,1 01:12:07:40 : KE4AZZ]SPCL, PCSAT-11\*, qAR, AE7AF:=2702.06N/08209.93Wy KE4AZZ EL87 01:12:09:59 : KE4AZZ]SPCL,W3ADO-1\*,XBAUD,qAO,W0ARP-14:=2702.06N/08209.93W-KE4AZZ e187 01:12:10:01 : KE4AZZ SPCL, PCSAT-11\*, qA0, W0ARP-14:=2702.06N/08209.93Wy KE4AZZ EL87 01:12:11:56 : KE4AZZ SPCL,W3ADO-1\*, qAR,N6DAN-1:=2702.06N/08209.93W-KE4AZZ e187 01:12:12:06 : KE4AZZ SPCL, PCSAT-11\*, qAR, N6DAN-1:=2702.06N/08209.93Wy KE4AZZ EL87 01:12:14:04 : KE4AZZ]SPCL,W3ADO-1\*,qAR,N6DAN-1:=2702.06N/08209.93W-KE4AZZ e187 01:12:14:23 : KE4AZZ SPCL, PCSAT-11\*, gA0, XE2KK-1:=2702.06N/08209.93Wy KE4AZZ EL87 01:13:35:12 : W3ADO-1]BEACON,SGATE,qAR,ON7EQ-10:T#001,042,105,071,048,216,11111111,0000,1 01:13:36:02 : OH2JIU VPTW07, W3ADO-1\*, qAU, DC8LZ-10: '5Hal E-/]= 01:13:52:05 : KE4AZZ]APS224, PCSAT-11\*, qAR, KC2GOW-1:=2702.06N/08209.93Wy KE4AZZ EL87 01:13:53:40 : KE4AZZ]APS224,PCSAT-11\*,gAR,KG4PID-12:=2702.06N/08209.93Wy KE4AZZ EL87

#### Slow Scan TV (SSTV) from ISS



#### **ARISS SSTV Event Scheduled for Dec 26**

December 21, 2021— An ARISS Slow Scan TV (SSTV) event is scheduled from the International Space Station (ISS). The event is slated to begin on **December 26 at 18:25 UTC** for setup and operation and continue until **December 31 ending at 17:05 UTC**. Dates and times subject to change due to ISS operational adjustments.

Images will be downlinked at 145.8 MHz +/- 3 KHz for Doppler shift and the expected SSTV mode of operation is PD 120. The main theme will be for this event will be lunar exploration. Radio enthusiasts participating in the event can post and view images on the ARISS SSTV Gallery at <u>https://www.spaceflightsoftware.com/ARISS\_SST</u> V/.

After your image is posted at the gallery, you can acquire a special award by linking to <u>https://ariss.pzk.org.pl/sstv/</u> and follow directions for submitting a digital copy of your received image.

#### https://hamsoft.ca/pages/mmsstv.php

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CESKC (VESKC.MDT) - MMSSTV Ver0.08	
Sync   RX   History TX   Template	TX Mode 1200 1500 1900 2300
VESKC MMSSTV Ver0.03	Auto Robot 36 Robot 72 AVT 90
	Scottie 1       Scottie 2       Log       Scottie DX       Call JE3HHT       His       595       Martin 1       Name       Mako       QTH       Japan
	AGC Note MMSSTV Test
TX     Tune     Image: Stocked templates	Fast     QSO     Data     Find     Clear     List     14.230       I     Show superimposed templates     1/50     ▲

QSSTV - Linux Macrobot - Mac Multimode - Mac ChromaPix - Win JVComm - Win GSH-PC - Win MMSSTV - Win MScan - Win

#### https://www.spaceflightsoftware.com/ARISS\_SSTV/ http://ariss-sstv.blogspat.com/





ARISS Celebrating 20 Years of Continuous Operations on ISS ARISS отмечает 20-летие непрерывной паботы на MRC



#### ARISS SSTV AWEIRI

#### Ronald Scott Coppersmith KD9QOG

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Received SSTV images on the occasion of 20 years of amateur radio on the ISS. The images were sent via an amateur radio system installed on the Russian Segment of the International Space Station. Прикил SSTV isobgaineewin C MVC, по случаю 20-летик радиолобительства и MVC. Изобранения были отправлены черев радиолюбительскую систему установлениямо на Российском сегменте. Международной косминеной станции.

Pysonogenove Pagesonoferensesse Jammonaeten ak MBC Caprini Candrysce MYIOB ARDS International Chair Frank Sauris ANMOD ARDS Stevene Chair Diver Arment DCGBLC RSDBS Oregonogen Caprell Pagesono Caprell Pagesono Caprell Pagesono Caprell Pagesono Caprell Pagesono Caprell Bacturowski SP2CIRE ARDS SDY Anamed Manager Stevenet Scipmanoeski SC2COX



Алиатенг Radio on the luternational Space Station Любительское радко на борту Междукародной космической станции

NACA CASIS

#### Lunar Exploration Исследование Луны





ARISS SSTV Award

#### Ronald Scott Coppersmith KD9QOG

Received SSTV images from the ISS commemorating Lunar exploration. The images were sent via an amateur radio system installed on the Russian Segment of the International Space Station. Причим SSTV исобранениеs с MMC, посвященные исследованию Луни, Изображения были отправление через радилолобительскую систему установленную на Российском сегменте Международной космической станции.

Pyceopymine Pageosolarinaucz Berronwerce wa MMC Copyrol Caudopan (FUDI) ARSS International Chair Hours Bauer, SARHOO ABSS Europa Chair Oliver Armon DOBREL RSINS Oneporopa- excounter Armon Housenamer (Baunapan North Bauetaner, Balansen North Bauetaner, Balansen Mentor ARSS Europa Mentor ARSS Europa



Amateur Radio on the International Space Station Вюбительское радно на Борту Международной космической станции

Bocember 26 - 31, 2021



#### https://www.amsat.org/fm-satellite-frequency-summary/

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		AMS	AT Fox-1 Satellites
	Uplink FM (67 Hz CTCSS)	Downlink FM	Comments
AO-91 (RadFxSat / Fox-1B)	435.250 MHz	145.960 MHz	Operational - Due to battery status, please do not attempt to access while in eclipse.
		SO	-50 (SaudiSat-1C)
	Uplink FM (67 Hz CTCSS)	SO- Downlink FM	-50 (SaudiSat-1C) Comments

		A0-27	
	Uplink FM	Downlink FM	Comments
AO-27	145.850 MHz	436.795 MHz	Operational
Currently active for four minute	es on ascending and des	ending passes over mid-latitudes of	the Northern Hemisphere
		ISS Crossband Repe	ater
	Uplink FM (67 Hz CTCSS)	Downlink FM	Comments
ISS Crossband Repeater	145.990 MHz	437.800 MHz	Operational
See ARISS Status for status info	ormation		

#### https://amsat-uk.org/beginners/how-to-work-fm-satellites/



The order of operation is: (allow for Doppler as necessary) 1) Transmit on 145 850 MHz with a tone of 74.4 Hz to arm the 10 minute timer on board the spacecraft 2) Now transmit on 145.850 MHz (FM Voice) using 67.0 Hz within the 10 minute window. 3) Sending the 74.4 Hz tone again within the 10 minute window will reset the 10 minute timer.



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You can set the memory channels in your handheld as follows CTCSS **RX** Timer Reset 74.4 Hz 145 850 436.805 67.Hz 67 Hz 145 850 436.800 436.795 67.Hz 145.850 436,790 67 Hz 145 850 436.785 67 Hz At the start of the pass tune to 436 805 and then decrease the trequency during the 10+ minute pasa.



OSCAR News, is full of Amateur Satellite information and free to members. Join us from £15 per year - AMBAT-UK Membership

Net 10am every Sunday on 3.780 MHz LSB



Operating Awards

G3AAJ Trophy

WebSDRs for Satellite Reception

QO-100 10 GHz Geostationary Satellite

144-146 MHz Goonhilly in Comwall

144 and 435 MHz Farnham near London

http://www.aprs.org/ https://www.ariss.org/ https://www.amsat.org/amateur-radio-on-the-iss/ https://www.ariss.org/current-status-of-iss-stations.html https://amsat-uk.org/beginners/how-to-work-the-iss-on-aprs-packet-radio/ https://wiki.satnogs.org/ https://wireless.nd.edu/notre-dame-radio-society/ https://www.astroviewer.net/iss/en/ https://www.amsat.org/track/index.php https://www.amsat.org/status/ https://amsat.org.ar https://www.n2yo.com/ https://in-the-sky.org/satmap\_worldmap.php https://aprs.fi/ http://www.findu.com/cgi-bin/pcsat.cgi http://www.ariss.net/ http://hamradiocrashcourse.com/

Ham Radio Crash Course, Ham Nation How to Talk to Satellites Using Ham Radio Part 1 With Sean KX9X https://www.youtube.com/watch?v=Q0NLo1LSIKU How to Talk to Satellites Using Ham Radio Part 2 with Sean Kutzko KX9X! https://www.youtube.com/watch?v=W9sDW1dDI https://spotthestation.nasa.gov/tracking\_map.cfm

