Spectrum Monitoring and Surveillance

Remote Spectrum Monitor Family of Interference Hunting Solutions

MS27101A Indoor Spectrum Monitoring

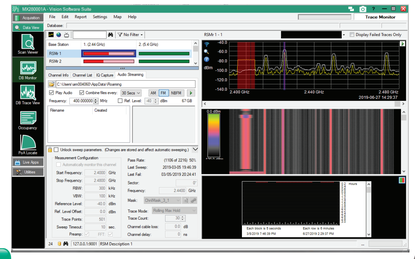
MS27102A Outdoor Spectrum Monitor System

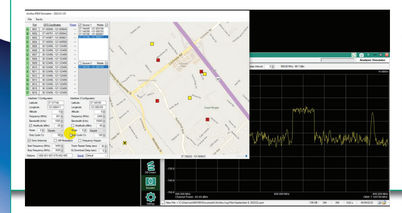
MS27103A Satellite Monitoring System

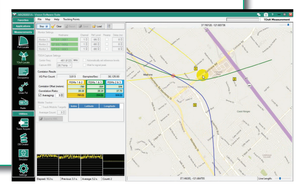
MS27201A Remote Spectrum Monitor

Control through Vision, Web Server or Custom Application

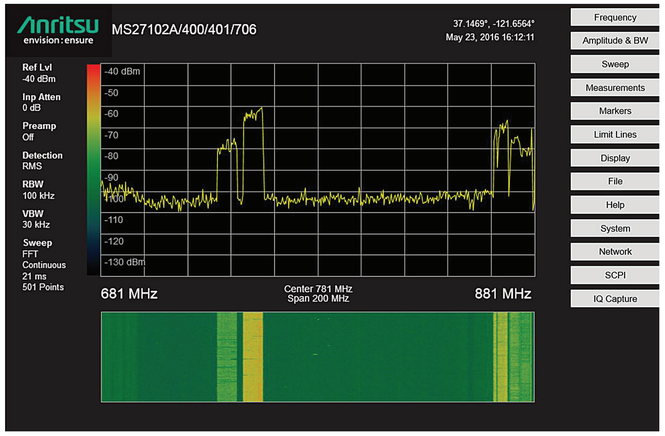
The Vision™ software platform works with Anritsu's spectrum monitoring hardware to automate the process of collecting measurement data, providing useful information about network health and use of the spectrum. Using multiple hardware probes covering a wide geographical area, Vision™ presents a comprehensive picture of spectral activity to assist users in monitoring the spectrum for unusual activity. Automated spectrum measurements, setting of alarms with e-mail notifications and geo-locating signal sources are features of the Vision™ software platform.







Spectrum Monitoring Solutions to facilitate and identify interference signals



System Features:

- Frequency range from 9 kHz to 6 GHz
- Sweep speed up to 24 GHz/s
- Linux operating system
- Integrated web server to view, control and conduct measurements via web browser
- IQ block and streaming mode with time stamping for TDOA measurements
- Hardware watchdog timer to insure long-term stability for remotely deployed monitors
- Low spur levels for accurate signal discovery
- 20 MHz instantaneous FFT bandwidth
- Update firmware and add new features remotely
- MS27201A

Frequency Allocations for Public Safety (MHz)

25 – 50	764 – 776
150 – 162	794 – 806
173.2 – 173.4	806 – 821
220 – 222	821 – 824
450 – 470	851 – 866
470 – 512	866 – 869

Internet of Things/M2M

Name	Standard / Organization	Application	Spectrum Alloc.	Power	Range	Data Rate	Encryption	Network Type
Wireless USB	USB	Game controllers, printers, scanners, digital cameras, portable media players, hard disk drives, USB Flash Drives	3.1 – 10.6 GHz	-41.3 dB/m/MHz	3 – 10	53 – 480 Mbp	Possible	P2P
MA-USB			Agnostic					
DASH7	ISO/IEC 1800-7	Wireless sensor networking applications: Building automation, Access Control, Smart Energy, Location-Based Services (Foursquare, Novitaz, Facebook, etc), Mobile Advertising, Automotive (tire pressure monitoring system), Logistics (tracking of supplies/products)	433.92 MHz	1 – 2 mW	2000 m	200 kbs	128-bit AES	P2P
RFID	ISO 14223, ISO/IEC 14443, ISO/IEC 15693, ISO/IEC 18000, ISO/IEC 18092, ISO 18185, ISO/IEC 21481, ASTM D7434, ASTM D7435, ASTM D7580, ISO 28560-2	Logistics (inventory assets, people, etc), access management. Toll collections. Machine readable travel documents, Smarttdust, Airport baggage, Timing Sporting events, telemetry	120 – 150 kHz, 13.56 MHz, 433 MHz, 902 – 928 MHz, 2450 – 5800 MHz, 3.1 – 10 GHz	<1 mW	200 m	~ 26 kbps	Possible	P2P
Wireless HD	ITU-R 5.138	Digital network interface for wireless transmission of HD	59 – 66 GHz	<1 W	10 m	10 – 28 Gbps	DTPC	WVAN
TransferJet	ECMA 398, ISO/IEC 17568	Fast file transfer, data synchronization audio/video streaming	4.2 – 4.76 GHz	~ 70 dBm/MHz	0.3 m	375 Mbps	256 – bit AES	P2P
NFC	ECMA 340, ISO/IEC 18092	Authentication, Authorization, Electronics Payment, ID Tagging	13.56 MHz	<1 mW	<20 cm	~ 424 kbps	Possible	P2P
Miracast	WiFi P2P, Wi-Fi Direct	Screen Mirroring	2.4 GHz, 5 GHz	* See Wi-Fi IEEE 802.11a/b/g/n and IEEE 802.11a/ac/ax			WPA2	P2P
THREAD	IEEE 802.15.4 + 6LoWPAN	THREAD	2400 – 2483.5 MHz	100 mW	160 m	250 kb/s	128-bit AES	Mesh
ANT +	ANT + Alliance	Sports, wellness, calorimeters, blood pressure monitors, position tracking, homing devices, and thermometers	2.4 GHz	1 mW	100 m	1 Mb/s	AES-128	WSN
Cognitive Radio	IEEE 802.22 WG	Cognitive Radio	54 – 862 MHz	1 W	100 km	24 Mb/s	AES-GCM	WRAN
SigFox	SigFox	Global Cellular	902 MHz	25 mW	50 km	1 kbps	Possible	WSN
Weightless-N/W	Weightless SIG	M2M	915 MHz/TV White Space	40 mW / 4 W	5 km	0.001 – 10 Mb/	128-bit	LPWAN
ZigBee	IEEE 802.15.4	Home automation, smart grid, remote control	2400 – 2483.5 MHz	100 mW	10 m	20 – 250 kbs	128-bit AES	Mesh
Bluetooth	Bluetooth (formerly IEEE 802.15.1)	Wireless headsets, laptops, printers, wireless speakers, digital cameras, wireless keyboard, video games	2400 – 2483.5 MHz	100 mW	100 m	1 – 3 Mb/s	56/128-bit	WPAN
Bluetooth Smart (BLE)	Bluetooth (formerly IEEE 802.15.1)	Low-power IoT/ M–M applications	2400 – 2483.5 MHz	10 mW	35 m	1 Mb/s	128-bit AES	WPAN
Wi-Fi	IEEE 802.11a/b/g/n	WLAN	2400 – 2483.5 MHz	1 W	100 m	6–780 Mb/s	WEP, WPA, WPA2	WLAN
	IEEE 802.11a/ac/ax	WLAN	5 GHz	160 mW	35 m	433 Mbps @80 MHz BW 867 Mbps @ 160 MHz BW 6.77 Gbps @ 160 MHz BW & 8x8 MIMO	WEP, WPA, WPA2	WLAN
	IEEE 802.11af	WLAN	?	100 mW	> 1 km	26.7 Mbps	WEP, WPA, WPA3	WLAN
	IEEE 802.11ah	WLAN	?	100 mW	1 km	40 Mbps	WEP, WPA, WPA4	WLAN
	IEEE 802.11ad	Wi-Fi/WiGig	60 Ghz	10 mW	10 m	6.76 Gbps	128-bit AES	WLAN
Z-Wave	IEEE 802.11ah	Home automation, security	908.42 MHz	1–100 mW	30.5 m	100 kbs	Triple DES	Mesh
Wireless HART	HART 7 IEC 62591, EN62591	HART Sensor Wireless transfer, Wireless Sensors	2400 – 2483.5 MHz	100 mW	228 m	dictated by HART sensor	128-bit AES	WSN

Amateur Radio

Frequency (kHz)	Band	Operation Modes	Class Frequency Privileges
420.0 – 450.0	70 CM	CW, RTTY, Data, MCW, Test, SSB (Phone), Image	Novice, Tech w/5wpm, Tech No Code, General, Advanced, Extra
222.0 – 225.0	1.25 M	CW, RTTY, Data, MCW, Test, SSB (Phone), Image	
144.1 – 148.0 144.0 – 144.1	2 M	CW, RTTY, Data, MCW, Test, SSB (Phone), Image, CW Only	Novice, Tech w/5wpm, Tech No Code, General, Advanced, Extra
50.1 – 55.0	6 M	CW, RTTY, Data, MCW, Test, SSB (Phone), Image	Novice, Tech w/5wpm, Tech No Code, General, Advanced, Extra
50.0 – 50.1		CW Only	
28.100 – 28.300 28.300 – 28.500	10 M	CW, RTTY, Data SSB (Phone), CW	Novice, Tech w/5wpm
28.000 – 28.300 28.300 – 29.700		CW, RTTY, Data SSB (Phone), CW	General, Advanced, Extra
24.890 – 24.930 24.930 – 24.990	12 M	CW, RTTY, Data SSB (Phone), CW	General, Advanced, Extra
21.100 – 21.200	15 M	CW Only	Novice, Tech w/5wpm
21.025 – 21.200 21.300 – 21.450		CW, RTTY, Data SSB (Phone), CW, Image	General
21.025 – 21.200 21.225 – 21.450		CW, RTTY, Data SSB (Phone), CW, Image	Advanced
21.000 – 21.200 21.200 – 21.450		CW, RTTY, Data SSB (Phone), CW, Image	Extra
18.068 – 18.100 18.110 – 18.168	17 M	CW, RTTY, Data SSB (Phone), CW, Image	General, Advanced, Extra
4.025 – 14.150 14.225 – 14.350	20 M	CW, RTTY, Data SSB (Phone), CW, Image	General
14.025 – 14.150 MHz 14.175 – 14.350 MHz		CW, RTTY, Data SSB (Phone), CW, Image	Advanced
14.000 – 14.150 MHz 14.150 – 14.350 MHz		CW, RTTY, Data SSB (Phone), CW, Image	Extra
10.100 – 10.150	30 M	CW, RTTY, Data	General
10.100 – 10.150		CW, RTTY, Data	Advanced
10.100 – 10.150		CW, RTTY, Data	Extra
7.100 – 7.150	40 M	CW Only	Novice, Tech w/5wpm
7.025 – 7.150 7.225 – 7.300		CW, RTTY, Data SSB (Phone), CW, Image	General*
7.025 – 7.150 7.150 – 7.300		CW, RTTY, Data SSB (Phone), CW, Image	Advanced*
7.000 – 7.150 7.150 – 7.300		CW, RTTY, Data SSB (Phone), CW, Image	Extra*

*Phone operation is allowed on 7.025 – 7.100 MHz in Puerto Rico, US Virgin Islands and areas of the Caribbean south of 20° north latitude; and in Hawaii and areas near ITU Region 3, including Alaska.

1.800 - 2.000	160 M	CW, RTTY, Data SSB(Phone), CW, Image	General, Advanced, Extra

Amateur station operating at 1.900–2.000 MHz must not cause harmful interference to the radio location service and are afforded no protection from radiolocation operations.

Narrowband & Broadband Public Safety Frequencies

Spetrum Allocation	Standard/ Organization	Application	Power	Range	Data Rate
758 – 763 MHz	IMT	Nation Broadband Network Safety	500 W & 5 W	503 m & 1523 m	384 kb/s
763 – 769 MHz	IMT	FirstNet (private entity for Nationwide Broadband Safety)	500 W & 5 W	503 m & 1523 m	384 kb/s
769 – 775 MHz	IMT	Narrow Band Segment	500 W & 5 W	503 m & 1523 m	384 kb/s
788 – 793 MHz	IMT	Nation Broadband Network Safety	500 W & 5 W	503 m & 1523 m	384 kb/s
793 – 799 MHz	IMT	FirstNet (private entity for Nationwide Broadband Safety)	500 W & 5 W	503 m & 1523 m	384 kb/s
799 – 805 MHz	IMT	Narrow Band Segment	500 W & 5 W	503 m & 1523 m	384 kb/s
806 – 809 MHz	IMT	NPSPAC/Public Safety	500 W & 5 W	503 m & 1523 m	384 kb/s
809 - 815 MHz	IMT	Public Safety	500 W & 5 W	503 m & 1523 m	384 kb/s
815 – 816 MHz	IMT	Public Safety Expansion Band	500 W & 5 W	503 m & 1523 m	384 kb/s
4940 – 4990 MHz	IEEE 802.11y	Public Safety WLAN	1 W	100 m, P2P 50 km	216 Mb/s

Federal Government Frequency Allocations from 100 MHz to 1000 MHz

Frequency (MHz)	Allocation
108 – 117.975	Aeronautical Radionavigation
117.975 – 137	Aeronautical Mobile (Route)
137 – 138	Space Operation (space-to-Earth); Meteorological Satellite (space-to-Earth); Space Research (space-to-Earth); Mobile Satellite (space-to Earth)
148 – 149.9	Fixed; Mobile; Mobile Satellite (Earth-to-space)
149.9 – 150.05	Mobiile Satellite (Earth-to-space); Radionavigation-Satellite
150.05 – 150.8	Fixed; Mobile
157.0375 – 157.1875	Maritime Mobile
162.0125 – 173.2	Fixed; Mobile
173.4 – 174	Fixed; Mobile
220 – 222	Fixed; Land Mobile
225 – 399.9	Fixed; Mobile; Mobile-Satellite; Aeronautical Radionavigation
399.9 – 401	Radionavigation Satellite; Standard Frequency and Time Signal Satellite; Mobile-Satellite (Earth-to-space); Meteorological Aids; Meteorological Satellite (space-to-Earth); Space Research (space-to-Earth); Mobile-Satellite (space-to-Earth); Space Operation (space-to-Earth)
401 – 402	Meteorological Aids (radiosonde); Space Operations (space-to-Earth); Earth Exploration-Satellite (Earth-to-space); Meteorological-Satellite (Earth-to-space)
402 – 403	Meteorological Aids (radiosonde)
403 – 406	Meteorological Aids (radiosonde); Earth Exploration Satellite; Meteorological Satellite
406 – 406.1	Mobile-Satellite (Earth-to-space)
406.1 – 420	Fixed; Mobile; Radio Astronomy; Space Research (space-to-space)
420 – 450	Radiolocation
608 – 614	Land Mobile; Radio Astronomy
902 – 928	Radiolocation
932 – 935	Fixed
941 – 944	Fixed
960 – 1215	Aeronautical Radionavigation; Radionavigation Satellite (space-to-Earth)

Automotive Spectrum Use and Applications

Spectrum	System	Applications	Range
48 kHz	Ultrasonic	Park Assitance	0.2 m to 3.0 m
433 MHz, 868 MHz	RF	Remote Keyless Entry (RKE)	0 m – 10 m
1575.42 MHz 1227.6 MHz, 1176.45 MHz	GNSS	GPS	Global
800 MHz	Cellular	OnStar	Typical Cellular
24 GHz	RADAR	Adaptive Cruise Control, Blind Spot Detection, Cross Traffic, Alert, Rear Collision Warning	0.2 m – 20 m
76–77 GHz	RADAR	Adaptive Cruise Control, Emergency Breaking, Pedestrian Detection, Collision Avoidance	1 m – 150 m
76 – 81 GHz	RADAR	Future Automotive Radar Frequencies	
532 nm / 1550 nm	LIDAR	Emergency Breaking, Pedestrian Detection, Collision Avoidance	0.2 m – 120 m
Visual Spectrum	Video Camera	Traffic Sign Recognition, Lane Departure Warning, Surround View, Park Assistance	0 m – 80 m

Space & Naval: US and Pacific GNSS Frequencies

System	Signal	Frequency (MHz)	Wavelength (m)	Bandwidth (MHz)
GPS	L1	1575.42	0.190	15.345
GPS	L2	1227.6	0.244	11
GPS	L5	1176.45	0.255	12.5
QZSS	L5	1176.45	0.255	24
QZSS	L2C	1227.6	0.244	11
QZSS	E6/LEX	1278.75	0.235	20
QZSS	L1	1575.42	0.19	12

*** Some GNSS systems are still being developed so specific frequency and bandwidth data may be subject to change**

Scientific & Medical

Frequency Range		Bandwidth	Wavelength	Center Frequency	Availability
6.765 MHz	6.795 MHz	30 kHz	44.2 m	6.780 MHz	Subject to local acceptance
13.553 MHz	13.567 MHz	14 kHz	22.1 m	13.560 MHz	Worldwide
26.957 MHz	27.283 MHz	326 kHz	11.1 m	27.120 MHz	Worldwide
40.660 MHz	40.700 MHz	40 kHz	7.4 m	40.680 MHz	Worldwide
433.050 MHz	434.790 MHz	1.74 MHz	0.69 m	433.920 MHz	* Region 1 only and subject to local acceptance
902.000 MHz	928.000 MHz	26 MHz	0.33 m	915.000 MHz	* Region 2 only (with some exceptions)
2.400 GHz	2.500 GHz	100 MHz	120 mm	2.450 GHz	Worldwide
5.725 GHz	5.875 GHz	150 MHz	50 mm	5.800 GHz	Worldwide
24.000 GHz	24.250 GHz	250 MHz	12.4 mm	24.125 GHz	Worldwide
61.000 GHz	61.500 GHz	500 MHz	4.9 mm	61.250 GHz	Subject to local acceptance
122.000 GHz	123.000 GHz	1 GHz	2.4 mm	122.500 GHz	Subject to local acceptance
244.000 GHz	246.000 GHz	2 GHz	1.2 mm	245.00 GHz	Subject to local acceptance

US CDMA Channels (MHz)

#	DL	UL	BW
0	877	832	34
1	1960	1880	60
2	938	893	43
3	851	906	38
4	1855	1765	30
5	456	446	73
6	2140	1950	60
7	752	782	12
8	1842	1747	75
9	942	897	35
10	895	853	89
11	456	446	73
12	918	873	6
13	2655	2535	70
14	1962	1887	65
15	2132	1732	45
16	2657	2535	66
18	763	793	12
19	737	707	18
20	1542	1643	34
21	2190	2010	20

US GSM Channels (MHz)

#	DL	UL	BW
1	395	385	9.6
2	425	415	9.6
3	464	454	6.8
4	492	482	6.8
5	737	707	18
6	755	785	16
7	858	813	15
8	881	836	24.6
9	947	902	24.6
10	942	897	34.6
11	940	895	38.6
13	1842	1747	74.6
14	1960	1880	59.6

US UMTS Channels (MHz)

#	DL	UL	Bandwidth (MHz)
1	2140	1950	60
2	1960	1880	60
3	1842	1747	75
4	2132	1732	45
5	881	836	25
6	880	835	10
7	2655	2535	70
8	942	897	35
9	1862	1767	34.8
10	2140	1740	60
11	1485	1437	19.8
12	737	707	17
13	751	782	10
14	763	793	10
19	882	837	15
20	806	847	30
21	1503	1455	14.8
22	3550	3450	80
25	1962	1882	65
26	876	831	35

FDD LTE

#	UL Fc	DL Fc	BW	DUPLEX
1	1950	2140	60	190
2	1880	1960	60	80
3	1747	1842	75	95
4	1732	2132	45	400
5	836	881	25	45
6	835	880	10	45
7	2535	2655	70	120
8	897	942	35	45
9	1767	1862	35	95
10	1740	2140	60	400
11	1437	1485	20	48
12	707	737	17	30
13	782	751	10	-31
14	793	763	10	-30
17	710	740	12	30
18	822	867	15	45
19	837	882	15	45
20	847	806	30	-41
21	1455	1503	15	48
22	3450	3550	80	100
23	2010	2190	20	180
24	1643	1542	34	-101.5
25	1882	1962	65	80
26	831	876	35	45
27	815	860	17	45
28	725	780	45	55
29	-	722	11	-
30	2310	2355	10	45
31	455	465	5	10

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Advancing beyond

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