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## DCS-RFI from ECUADOR

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DCS-RFI-Ecuador-Mod2.ppt



# Geophysics Institute (IG)



- **Surveyed the RF Environment from Roof**
- **401.5 – 402.5 MHz**
- **Found only 3 Multiplexed Repeater Signals**
- **Each Signal had 3-4 multiplexed seismic or repeater signals**
- **Rest of spectrum 401.0 – 402.5 MHz was clear**

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# IG Roof Antennas



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# Alion Science Test Equipment



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# Alion Test Antenna Rotator



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# Patti Mothes, Vulcanologist



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# IG Personnel w/Sandra Wright



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# IG 24-Hour Operations



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# 24-hour Operations Center Recorders



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- COLOMBIA**
- c1. Galeras
  - c2. Azufral
  - c3. Doña Juana
  - c4. Cumbal
  - c5. Cerro La Quinta
  - c6. La Envidia

- ECUADOR**
- |  |                                     |
|--|-------------------------------------|
| 1. Cerro Negro de Mayasquer  | 46. Pan de Azúcar                   |
| 2. Chiles  | 47. Sumaco                          |
| 3. Peña Blanca (Chiltazón)   | 48. Corazón                         |
| 4. Cerro Payurco   | 49. Ruminahui (Yuyancazo)           |
| 5. Potrerillos   | 50. Almas Santas                    |
| 6. Caldera de Chalpatán  | 51. Iliniza                         |
| 7. Chulamuez   | 52. Santa Cruz                      |
| 8. Horqueta  | 53. Cotopaxi                        |
| 9. El Mirador  | 54. Caldera de Chalupa              |
| 10. Iguán  | 55. Quilindaña                      |
| 11. Chaquilulo (Azufral)   | 56. Quiltoa                         |
| 12. Loma Padre Aragan (Chinibano)                                      | 57. Santapungo                      |
| 13. Loma La Breña  | 58. Angahuana                       |
| 14. Cerro El Recoso  | 59. Sagoatoo (Saguatoo)             |
| 15. Soche  | 60. Larcapungo                      |
| 16. Pilavo (Negropuno)   | 61. Huicutambo                      |
| 17. Yanaurcu de Piñan  | 62. Carihuairazo                    |
| 18. Huangullar o (Huagrabola)  | 63. Puñalica                        |
| 19. Loma El Volcán   | 64. Huisla                          |
| 20. Mangus (Mongus)  | 65. Chimborazo                      |
| 21. Cotacachi  | 66. Igualata                        |
| 22. Cuicocha   | 67. Tungurahua                      |
| 23. Imbabura   | 68. Lavas de Mera                   |
| 24. Cubilche   | 69. Cono Puyo (basálticos)          |
| 25. Cushnirumi   | 70. Cono Calpi (basálticos)         |
| 26. Cusín  | 71. Altar / Capac Urco (basálticos) |
| 27. Pululagua (Pululahua)  | 72. Cono Licto (basálticos)         |
| 28. Mojanda - Fuya Fuya  | 73. Sangay                          |
| 29. Viejo Cayambe  |                                     |
| 30. Nevado Cayambe   |                                     |
| 31. Casitagua  |                                     |
| 32. Pamba Marca  |                                     |
| 33. Izambi   |                                     |
| 34. El Reventador  |                                     |
| 35. Guagua Pichincha   |                                     |
| 36. Rucu Pichincha   |                                     |
| 37. Ilaló  |                                     |
| 38. Puntas   |                                     |
| 39. Caldera de Chacana Antisanilla (1760) Potrerillo/Papallacta (1773) |                                     |
| 40. Yanaurcu (Cerro Negro)   |                                     |
| 41. Ninahuilca   |                                     |
| 42. Atacazo  |                                     |
| 43. Paschoa  |                                     |
| 44. Sincholagua  |                                     |
| 45. Antisana   |                                     |





# CAYAMBE Volcano



- 
- **First test site**
  - **Close to IG – 4.5 hrs by 4x4 wheel drive**
  - **Typical seismic transmitter location**
  - **This site was geo-located 43 nmi to West because of reflection from glacier/rock face**

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# CAYAMBE Seismic Transmitter



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# CAYAMBE GPS



N 00 04' 14.5"

W077 59' 32.3"

Alt: 13,667'



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# COTACACHI Repeater Station

## 401.800 MHz



- **Repeater Station**
  - Receives 2 – 4 seismic sensor transmitters
  - Multiplexes signals onto one carrier at 401.8 MHz
- **Second Site located north of the IG and West of Cayambe**
- **Site is heavily encumbered with multiple military and commercial transmitters**
- **Out-of-band signals overwhelmed portable spectrum analyzer**

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# COTACACHI Military Antennas



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# COTACACHI Commercial Antennas



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# COTACACHI-IG Repeater Station



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# COTACACHI-IG GPS Coordinates



N 00 19' 55.1"

W078 20' 24.9"

Alt: 13,256'



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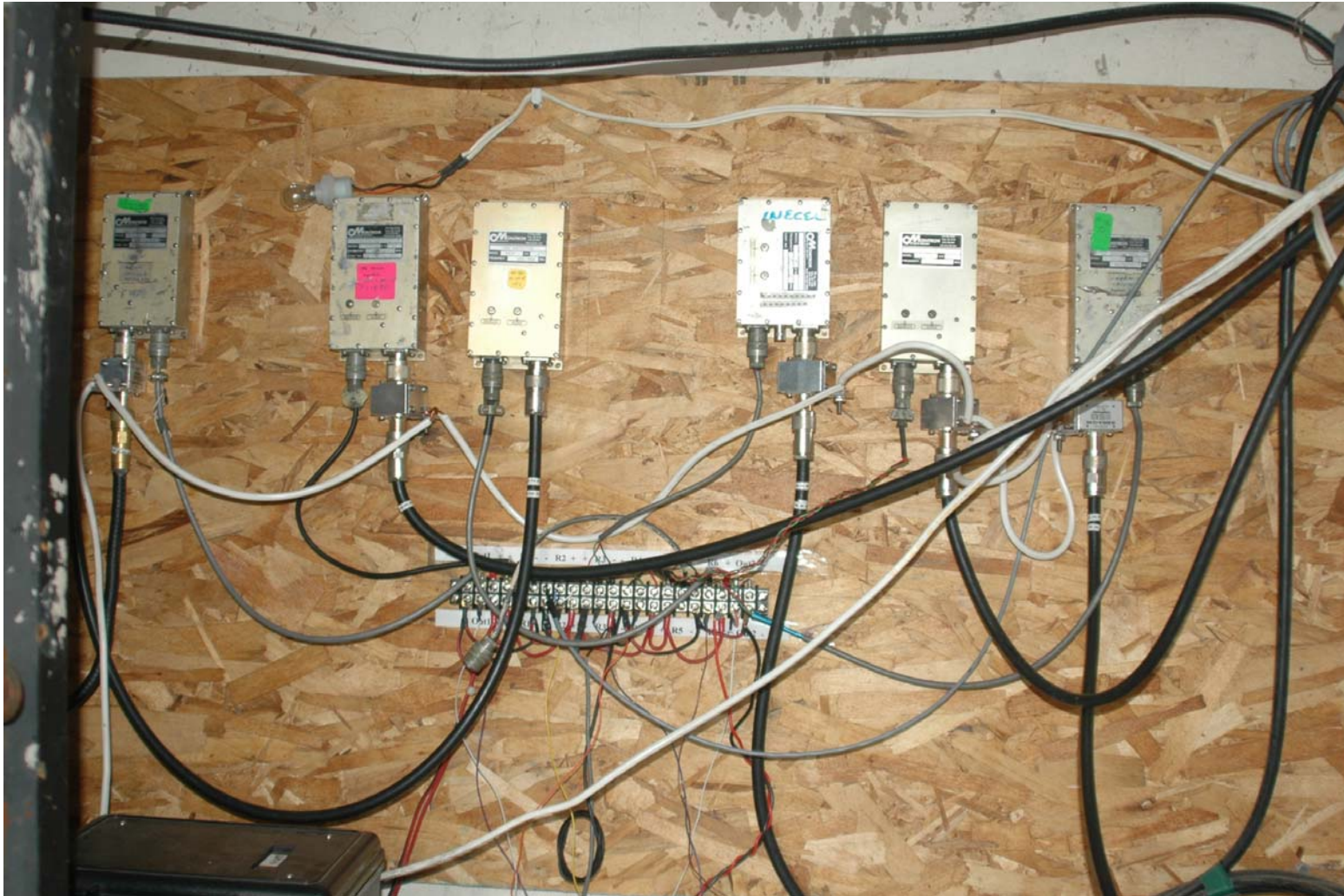
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# COTACACHI-IG RF Receivers/Transmitters



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# COTACACHI 401.8 MHz Repeater



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# Search for Rogue Transmitter at 401.8 MHz



- **Several geo-location overlapping circles**
- **Primary location bounded by ILINIZA-QUILOTOA**
- **Unable to penetrate area from East at Tocado**
  - **Detour to South and west of Latacunga**
  - **Followed dirt horse trails until road washout**
  - **Never received any signal at 401.8 MHz in this area**

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# Road Washout



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# Lost in the Andes Mountains



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# Difficult Terrain to Locate Rogue



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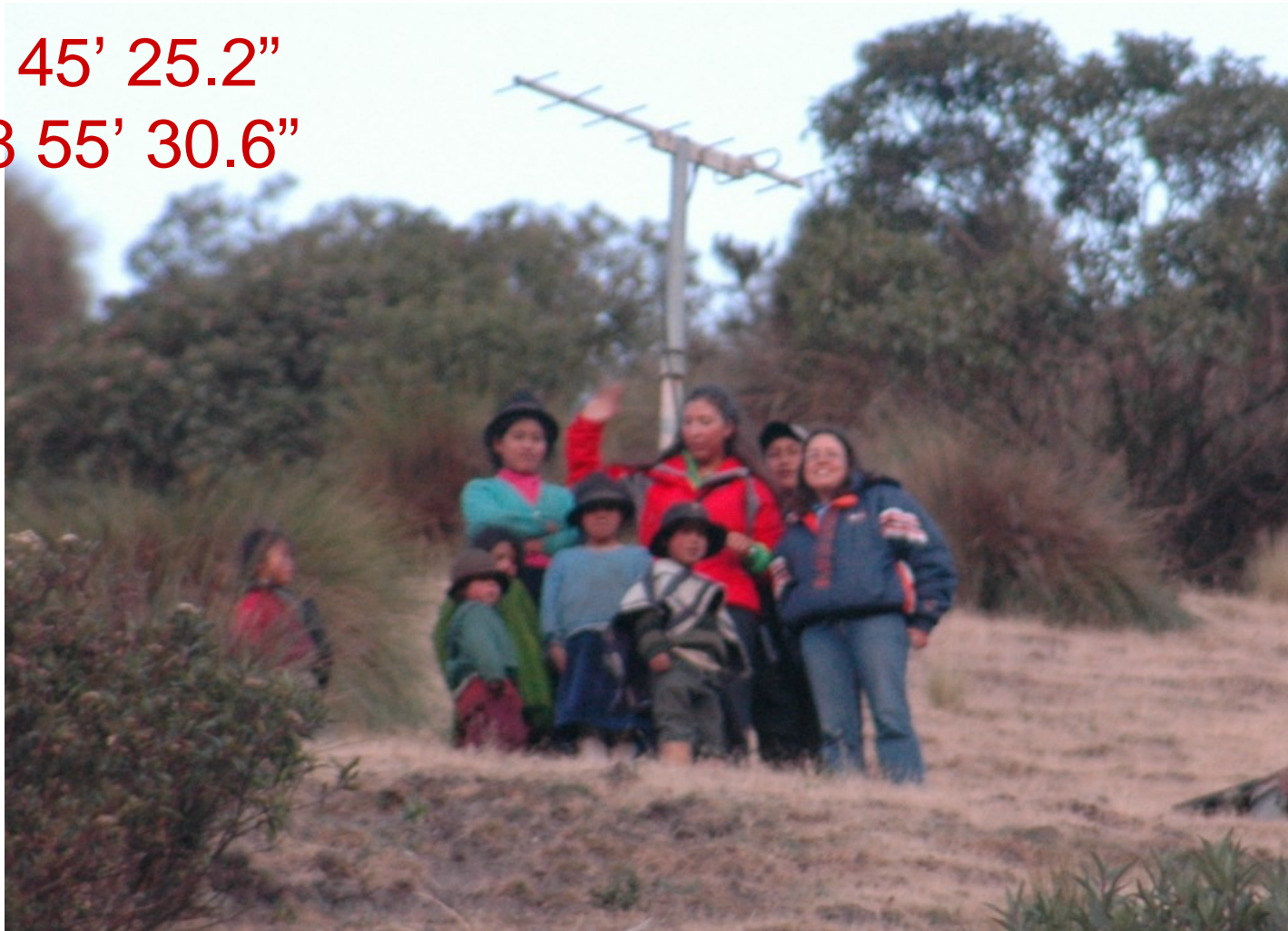
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# QUILOTOA Seismic Transmitter 401.650 MHz



S 00 45' 25.2"  
W078 55' 30.6"



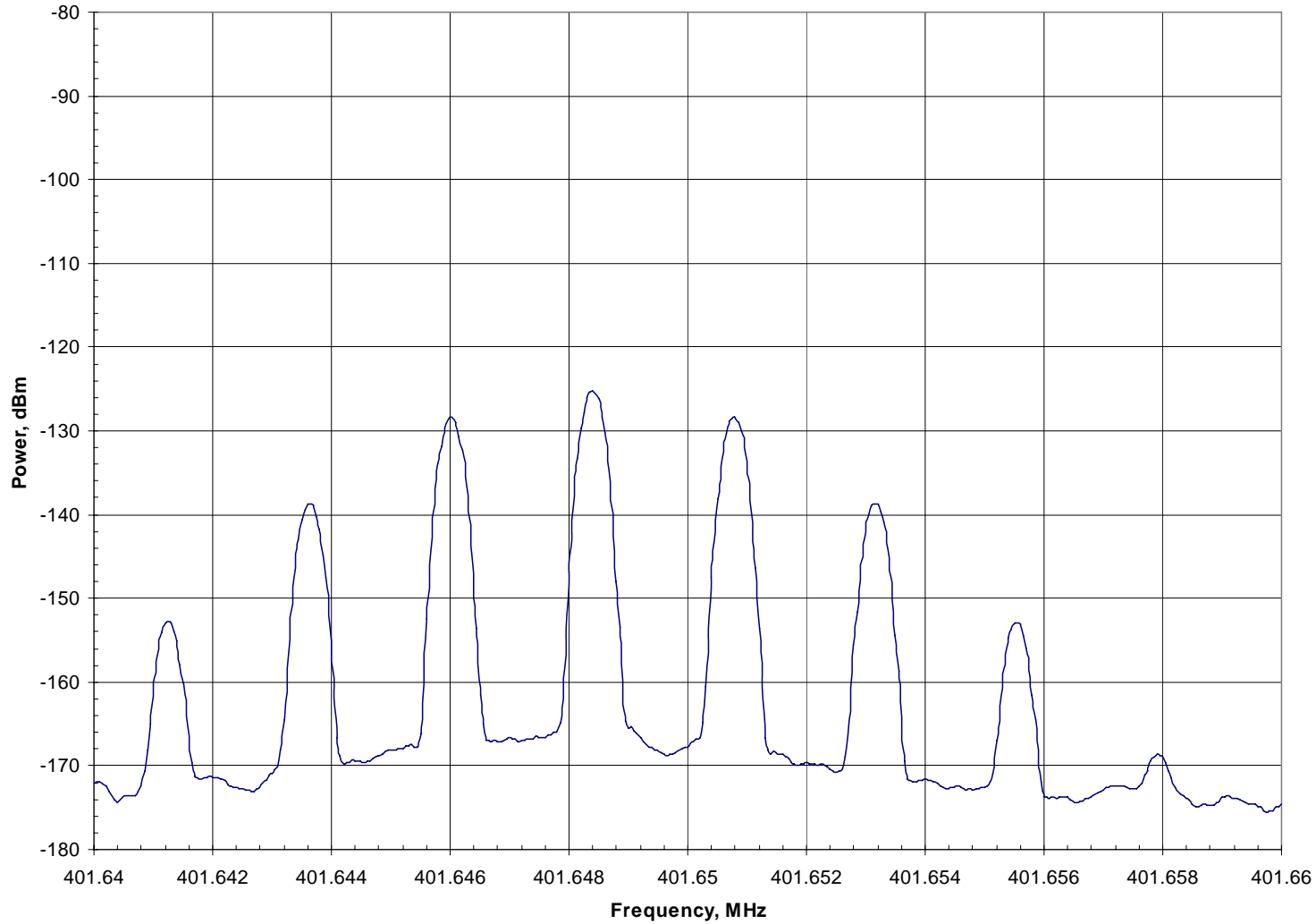
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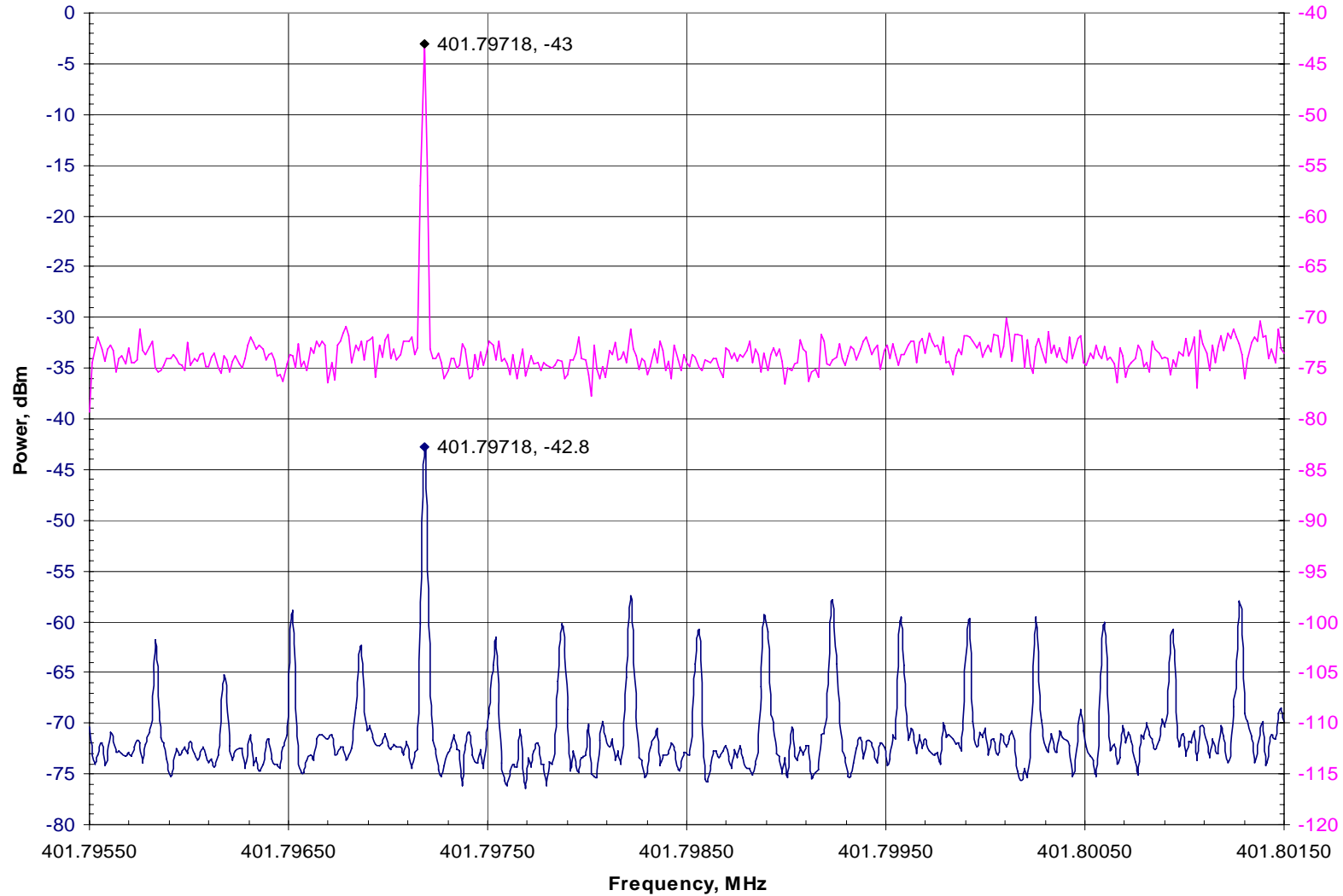
# Spectrum Analyzer plot of 401.650 MHz at QUILOTOA



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# WCDAS View of COTACACHI 410.8MHz Multiplexed Signal



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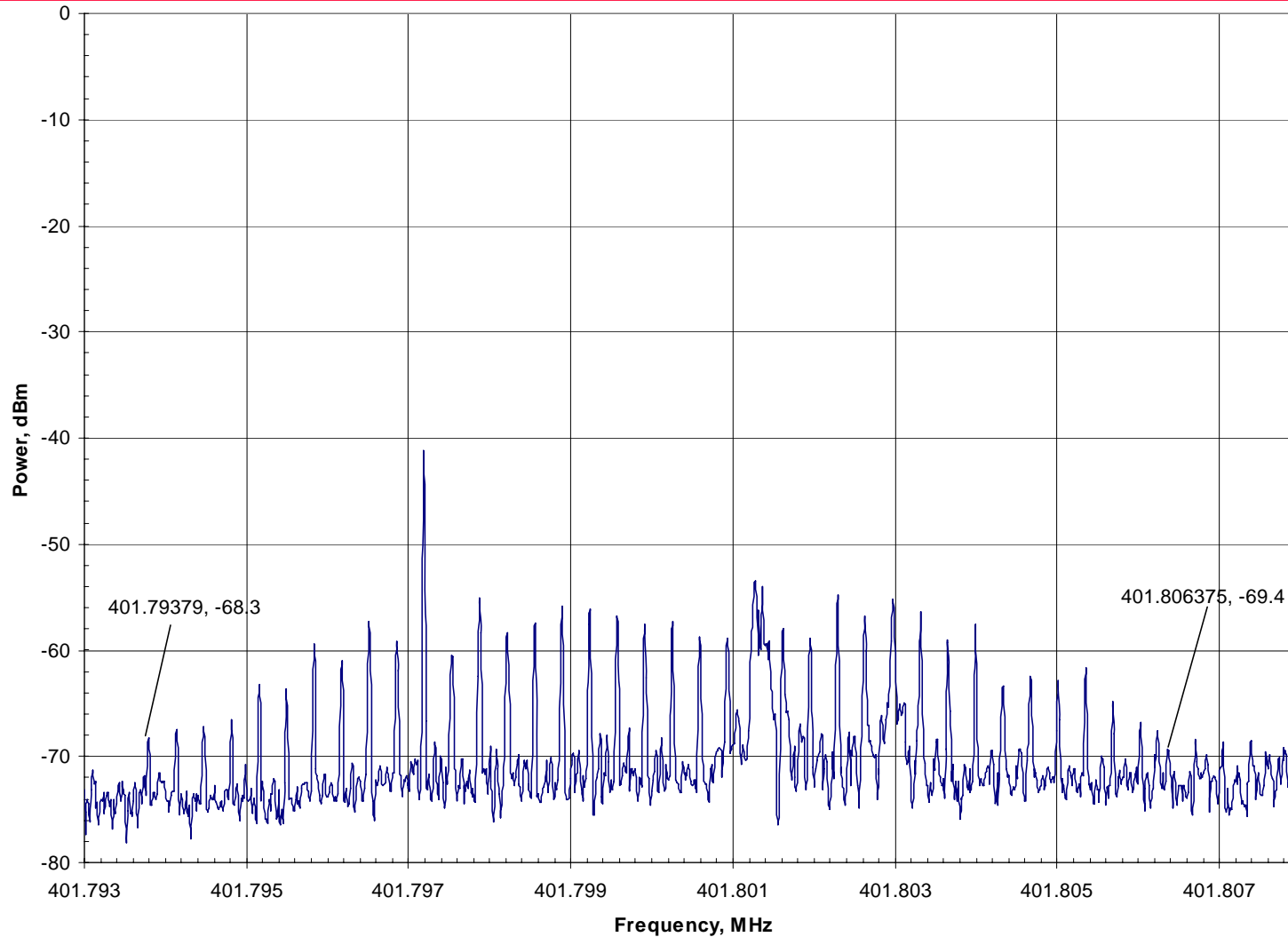
— Point At Satellite — Transmitter Off

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# COTACACHI Repeater at 401.800 MHz & 12.6kHz BW



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— Wallops CDAS DCS RFI

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**FRECUENCIAS DE VCO Y RADIOS**



<b>COTA1 :</b> 417.775Mhz 1360Hz	CENE : 680Hz, 404.200Mhz MAGD: 1700Hz, 401.050Mhz CAYA : 3060Hz, 401.600Mhz	SAN LORE: 2720Hz, 401.425Mhz
<b>COTA2:</b> 401.800Mhz	PINO : 401.950Mhz YANA: 2720Hz, 217.125Mhz	PINO: 1700Hz PINE: 680Hz PINN: 1360Hz
<b>MONJ 1 :</b> 216.125Mhz	ILINIZAS 1: 401.125Mhz	LOMA GRANDE 1: 217.225Mhz NASA: 2720Hz, 404.100Mhz RETU: 3060Hz, 401.250Mhz ULBA: 680Hz, 401.700Mhz RUN2: 1700Hz, 401.350Mhz CUSUA: 2040Hz, 401.600Mhz JUIVE5: 2380Hz, 408.509Mhz
<b>MONJ 2 :</b> 216.625Mhz	ILINIZAS 2: 401.500Mhz	CAMI: 1360Hz, 216.225Mhz MORURCO: 401.950 MO1V: 1020Hz MO1N: 1700Hz MO1E: 3060Hz
<b>San Fco 1:</b> 409.868Mhz	IGUALATA: 1020Hz 401.725Mhz	CARSHAO: 401.300Mhz ARRAYAN: 2380Hz, 401.500Mhz SALINAS: 680Hz, 401.600Mhz
<b>San Fco 2:</b> 401.625Mhz	LAGUNAS: 404.150Mhz PILISURCO: 404.300Mhz	2720 Hz, 401.900Mhz CAYV: 2040Hz CAYN: 2380Hz CAYE: 1360Hz PISAYAMBO: 1700Hz, 411.725Mhz
<b>VC1:</b> 401.025Mhz 3060Hz	TAMBO: 1360Hz, 416.793Mhz PITA: 2040Hz, 401.475Mhz ANTISANA: 1020Hz, 401.425Mhz	
<b>BORDE :</b> 411.775Mhz	TERRAZA: 416.793Mhz REFUGIO: 1700Hz, 401.275Mhz	TERV: 3060Hz TERN: 2720Hz TERE: 2040Hz QUILOTOA: 2380Hz, 401.650Mhz
<b>ATACAZ (PET):</b> 401.350Mhz	REVE: Micro +++ : Micro:	CONE: 2720Hz, 401.150Mhz LAVA3: 680Hz, 401.450Mhz COPETE: 1700Hz, 401.975Mhz CHARLIE: 3060Hz, 401.050Mhz
<b>ATACAZ (MIL):</b> 401.700Mhz	JAMA: 2720Hz, 401.950Mhz SAN. JORGE: 2040Hz, 401.650Mhz SAN. JUAN: 1700Hz, 415.987Mhz CUPA: 1360Hz, 412.275Mhz	
<b>COTR:</b> 401.050Mhz	COTV: 2720Hz COTE: 1700Hz COTN: 1360Hz	



ESCUELA POLITÉCNICA NACIONAL  
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**ACUERDO BILATERAL CON LA COMPAÑÍA ALION**

El Instituto Geofísico de la Escuela Politécnica Nacional y el NOAA ( National Oceanic and Atmospheric Administration) representado por la compañía Alion, luego de conversaciones mantenidas en nuestras dependencias durante la visita de los técnicos de dicha empresa a nuestro país acordaron en una primera etapa de cooperación mutua lo siguiente:

- Realizar un recorrido por algunas de las estaciones y repetidoras que forman parte de la red nacional de sismógrafos y observatorios volcánicos que mantiene el Instituto Geofísico en el Ecuador para realizar un monitoreo de os equipos allí instalados.
- El NOAA se compromete a llevar a Estados Unidos 20 radios de Marca Monitron que se encuentran dañados, para su reparación y posterior devolución al Instituto Geofísico en Ecuador, que se detallan a continuación.

Transmitters			Receivers		
Frequency (MHz)	Serial Number	Problem	Frequency (MHz)	Serial Number	Daño
401.600	1297	No Power tx	404.300	3237	No Reception
401.475	1866	No Power tx	401.475	1314	No Reception
401.575	1413	No Power tx	401.725	1653	No Reception
401.350	1416	No Power tx	401.450	3516	Source broken
401.750	1655	No Power tx	401.700	2126	No Reception
401.525	1412	No Power tx	216.125	702	No Reception
401.150	2667	No signal	401.475	1291	No Reception
401.075	2664	No Power tx	401.250	1632	Without crystal and main chip
			401.600	3334	No Reception
			401.350	2111	Reception bad
			401.450	1290	Without main chip
			401.525	1931	No Reception

las partes firman el presente acuerdo de cooperación en Quito 18 de Agosto de 2005.

  
 Lawrence Crippin  
 COMPAÑIA ALION


  
 Ing. Hugo Yepes  
 DIRECTOR INSTITUTO GEOFÍSICO

GANADOR DEL PREMIO MUNDIAL SASAKAWA-UNDRO 1992  
 A la mejor labor en Mitigación de Desastres