

G00184



G00184

Date

"
A Study on 150 MHz band RFI
& Detect usable band "

By: S. Sureshkumar / Ajit Kumar

Dated: 20/9/2002

Preliminary Report

* Thanks to Prof. SAK/jay / J. Ramesh Sathabathy / Kalpeth

/ Gopi / Ramesh

C12 Antenna - 18th Sep, 2002

Experimental Setup & Conclusion

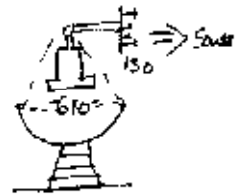
ON 150 MHz RFI

System Set-up

Servo: Az angle = 0° , Elevation = 90°

FPS: 610 MHz Feeds focus, 150 MHz Feeds Pointing to South

F-End: 150 MHz Selected, 150 MHz Filter after 150 LNA is removed and a 4 dB PAD Put between LNA and Post Amplifier for matching.



Common box bypassed

I.F: Not included

OF: CH1 of F-End with above setting is Connected to OF-Tx at base and recorded using 30:1 Switch. Also monitored using OF Monitor Port & AOR Receiver.

Experiment started at ≈ 20.30 ON 18/9/2002 & ended at ~~14.00~~ ~~at~~ ON 19/9/2002

Enclosures: I Plot taken at antenna base, F-End O/P, CH1, Without 150 Filter.

II " " " " CH2, With 150 Filter

III Plot taken at Rx-Room at OF Monitor Port, CH1 OF F-E,

IV 30:1 Recording - Gray Scale Plot. Without 150 Filter

Conclusion: Exact frequency mentioned will have ± 1 MHz error.

PLOT I. The CLEAN BAND : 147.8 MHz to 157.4 MHz ≈ 9.6 MHz B.W
: 168.5 MHz to 173.6 MHz ≈ 5.1 MHz B.W

PLOT II The CLEAN BAND : 148.0 MHz to 157.5 MHz ≈ 9.5 MHz B.W
: 166.0 MHz to 173.8 MHz ≈ 7.8 MHz B.W

PLOT III The CLEAN BAND : 147.8 MHz to 157.7 MHz \approx
167.3 MHz to 173.6 MHz \approx

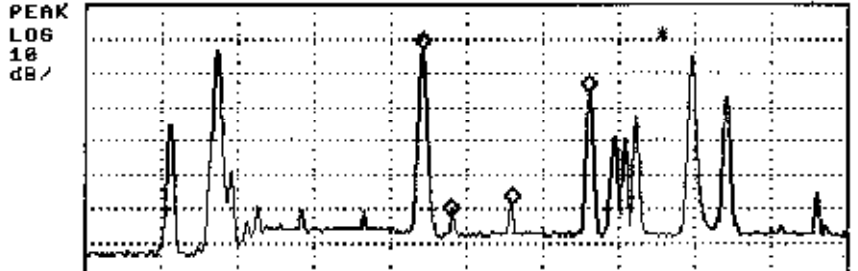
PLOT IV The CLEAN BAND : 30:1 Recording GRAY SCALE Confirms the Clean band
with T.V ON/OFF, F.M ON/OFF.



G00184

CH2
Plot 15

12:56:55 SEP 19, 2002
 18:09:45 SEP 18, 2002
 REF -20.0 dBm #AT 0 dB MKR 159.2 MHz
 -45.87 dBm

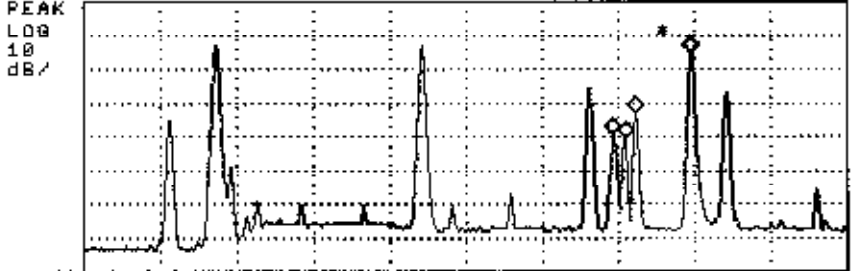


Marker	Trace	Type	Freq / Time	Amplitude
1:	(A)	Freq	139.1 MHz	-33.22 dBm
2:	(A)	Freq	137.6 MHz	-82.85 dBm
3:	(A)	Freq	147.2 MHz	-78.62 dBm
4:	(A)	Freq	159.2 MHz	-45.87 dBm

START 80.0 MHz #RES BW 300 kHz #VBW 3 kHz STOP 200.0 MHz
 SMP 400 msec

MARKER NORMAL
 MARKER ▲
 MARKER AMPTD
 SELECT 1 2 8 4
 MARKER 4 ON OFF
 More 1 of 2

12:57:32 SEP 19, 2002
 18:03:45 SEP 18, 2002
 REF -20.0 dBm #AT 0 dB MKR 175.4 MHz
 -35.36 dBm

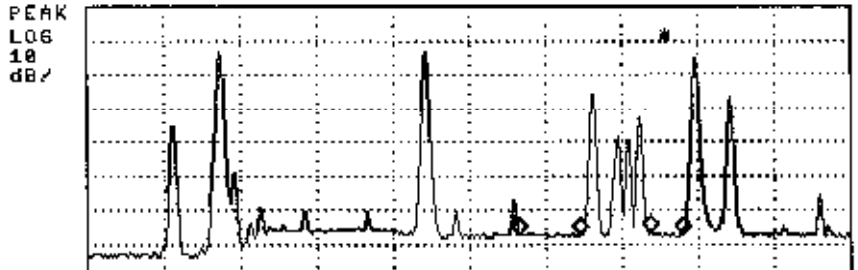


Marker	Trace	Type	Freq / Time	Amplitude
1:	(A)	Freq	169.1 MHz	-59.29 dBm
2:	(A)	Freq	165.2 MHz	-60.52 dBm
3:	(A)	Freq	166.7 MHz	-52.86 dBm
4:	(A)	Freq	175.4 MHz	-35.36 dBm

START 80.0 MHz #RES BW 300 kHz #VBW 3 kHz STOP 200.0 MHz
 SMP 400 msec

MARKER NORMAL
 MARKER ▲
 MARKER AMPTD
 SELECT 1 2 3 4
 MARKER 4 ON OFF
 More 1 of 2

12:58:51 SEP 19, 2002
 18:08:45 SEP 18, 2002
 REF -20.0 dBm #AT 0 dB MKR 173.6 MHz
 -87.68 dBm



Marker	Trace	Type	Freq / Time	Amplitude
1:	(A)	Freq	147.8 MHz	-87.26 dBm
2:	(A)	Freq	157.4 MHz	-87.34 dBm
3:	(A)	Freq	168.5 MHz	-86.81 dBm
4:	(A)	Freq	173.6 MHz	-87.68 dBm

START 80.0 MHz #RES BW 300 kHz #VBW 3 kHz STOP 200.0 MHz
 SMP 400 msec

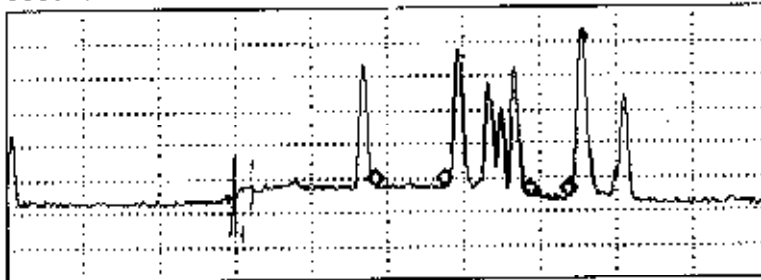
MARKER NORMAL
 MARKER ▲
 MARKER AMPTD
 SELECT 1 2 3 4
 MARKER 4 ON OFF
 More 1 of 2

Plot I

18:07:09 SEP 19, 2002
 18:09:28 SEP 18, 2002
 REF -30.0 dBm AT 10 dB

MKR 173.8 MHz
 -85.78 dBm

PEAK
 LOG
 10
 dB/



Marker	Trace	Type	Freq / Time	Amplitude
1:	(A)	Freq	148.5 MHz	-82.53 dBm
2:	(A)	Freq	157.5 MHz	-82.41 dBm
3:	(A)	Freq	168.8 MHz	-85.98 dBm
4:	(A)	Freq	173.8 MHz	-85.78 dBm

CENTER 150.0 MHz #RES BW 300 kHz #VBW 3 kHz SPAN 100.0 MHz SWP 888 msec

MARKER NORMAL

MARKER Δ

MARKER AMPTD

SELECT 1 2 3 4

MARKER 4 ON OFF

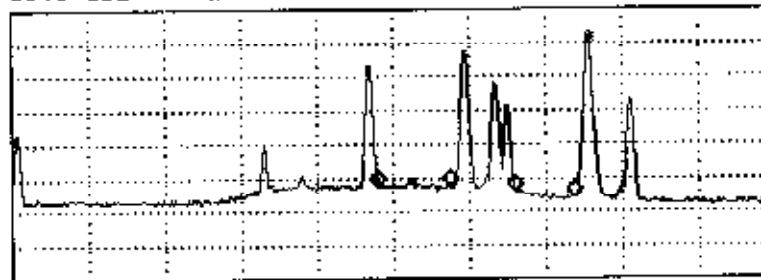
More 1 of 2

18

18:08:17 SEP 19, 2002
 18:09:38 SEP 18, 2002
 REF -30.0 dBm AT 10 dB

MKR 173.8 MHz
 -86.24 dBm

PEAK
 LOG
 10
 dB/



Marker	Trace	Type	Freq / Time	Amplitude
1:	(A)	Freq	148.8 MHz	-82.72 dBm
2:	(A)	Freq	157.5 MHz	-82.34 dBm
3:	(A)	Freq	166.8 MHz	-83.99 dBm
4:	(A)	Freq	173.8 MHz	-86.24 dBm

CENTER 150.0 MHz #RES BW 300 kHz #VBW 3 kHz SPAN 100.0 MHz SWP 888 msec

MARKER NORMAL

MARKER Δ

MARKER AMPTD

SELECT 1 2 3 4

MARKER 4 ON OFF

More 1 of 2

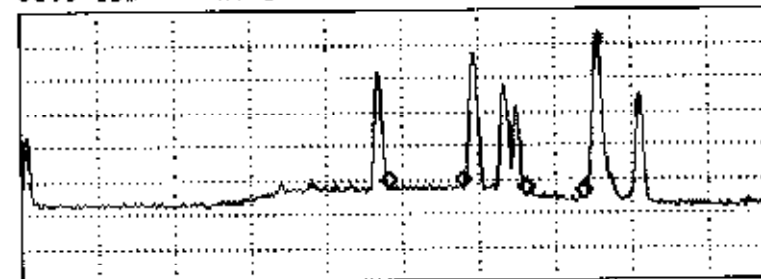
PLOT II

19

18:09:03 SEP 19, 2002
 18:09:56 SEP 18, 2002
 REF -30.0 dBm AT 10 dB

MKR 173.8 MHz
 -86.21 dBm

PEAK
 LOG
 10
 dB/



Marker	Trace	Type	Freq / Time	Amplitude
1:	(A)	Freq	148.8 MHz	-82.50 dBm
2:	(A)	Freq	158.8 MHz	-82.46 dBm
3:	(A)	Freq	166.8 MHz	-84.84 dBm
4:	(A)	Freq	173.8 MHz	-86.21 dBm

CENTER 150.0 MHz #RES BW 300 kHz #VBW 3 kHz SPAN 100.0 MHz SWP 888 msec

MARKER NORMAL

MARKER Δ

MARKER AMPTD

SELECT 1 2 3 4

MARKER 4 ON OFF

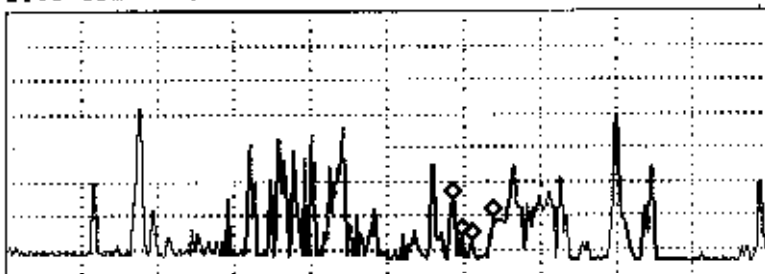
More 1 of 2

20

15:22:04 19 SEP 2002
23:20:35 18 SEP 2002
REF -10.0 dBm #AT 0 dB

MKR 155.5 MHz
-70.84 dBm MK TRACK ON OFF

PEAK LOG 10 dB/



MK COUNT ON OFF

MK TABLE ON OFF

MK NOISE ON OFF

MK PAUSE ON OFF

Marker	Trace	Type	Freq / Time	Amplitude
1:	(A)	Freq	150.2 MHz	-65.20 dBm
2:	(A)	Freq	151.7 MHz	-76.48 dBm
3:	(A)	Freq	153.2 MHz	-77.69 dBm
4:	(A)	Freq	155.5 MHz	-70.84 dBm

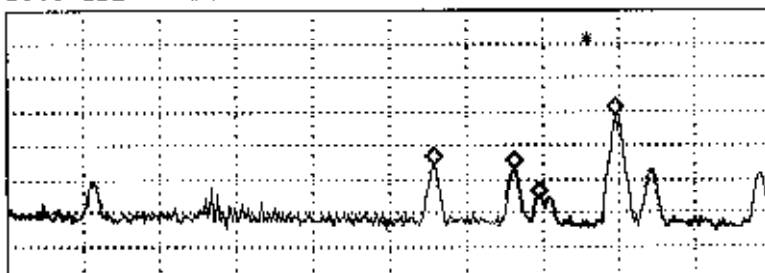
None 1 of 2

START 80.0 MHz #RES BW 100 kHz #VBW 8 kHz STOP 200.0 MHz SWP 1.20 sec

15:23:57 19 SEP 2002
23:20:35 18 SEP 2002 23:48
REF -10.0 dBm #AT 0 dB

MKR 175.4 MHz
-41.21 dBm

PEAK LOG 10 dB/



MARKER NORMAL

MARKER A

MARKER AMPTD

SELECT 1 2 3 4

MARKER 4 ON OFF

None 1 of 2

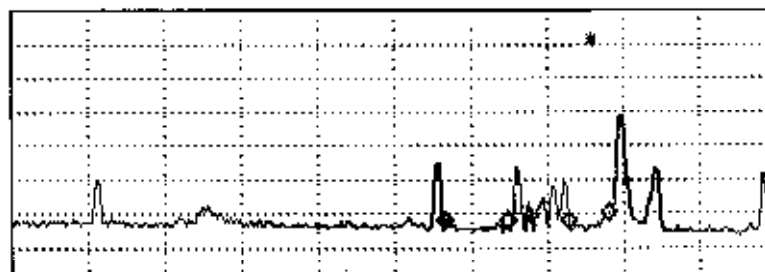
Marker	Trace	Type	Freq / Time	Amplitude
1:	(A)	Freq	146.9 MHz	-55.92 dBm
2:	(A)	Freq	159.5 MHz	-57.06 dBm
3:	(A)	Freq	163.4 MHz	-65.92 dBm
4:	(A)	Freq	175.4 MHz	-41.21 dBm

START 80.0 MHz RES BW 1.0 MHz VBW 200 kHz SWP 20.0 msec STOP 200.0 MHz

15:25:18 19 SEP 2002
23:20:35 18 SEP 2002 23:51
REF -10.0 dBm #AT 0 dB

MKR 173.6 MHz
-72.35 dBm

PEAK LOG 10 dB/



MARKER NORMAL

MARKER A

MARKER AMPTD

SELECT 1 2 3 4

MARKER 4 ON OFF

None 1 of 2

Marker	Trace	Type	Freq / Time	Amplitude
1:	(A)	Freq	147.0 MHz	-74.56 dBm
2:	(A)	Freq	157.7 MHz	-74.44 dBm
3:	(A)	Freq	167.9 MHz	-74.54 dBm
4:	(A)	Freq	173.6 MHz	-72.35 dBm

START 80.0 MHz #RES BW 300 kHz VBW 100 kHz SWP 20.0 msec STOP 200.0 MHz

PLOT III

C-5 Antenna - 18th Sep. 2002

Experimental Setup & Conclusion

On 150MHz RFI

System Set-up

Setup: Az angle = 0° , Elevation = 90°

FPS: 150 FEED FOCUS

F.End: F.End Common Box OUTPUT was connected to Fiber Optics input at Antenna base. 150MHz Selected, Solar Atten. = 14 dB CH1 used for measurement.

I.F : NOT included.

OF : F.End Signal was recorded at Rx using 30:1 Switch & monitored.

Experiment started at 20:30 on 18/9/2002 & ended at 9:30 hrs on 19/9/2002.

Enclosures: Plot V taken at OF monitor Port

Plot VI 30:1 Recording from 20:30 18/9/2002 to 9:30 19/9/2002

Conclusion:

Plot V: * With Feed at focus, 150MHz Filter in F.End box, Common Box included we see the band 147MHz to 157MHz is Clean. Also 166MHz to 173MHz Clean.

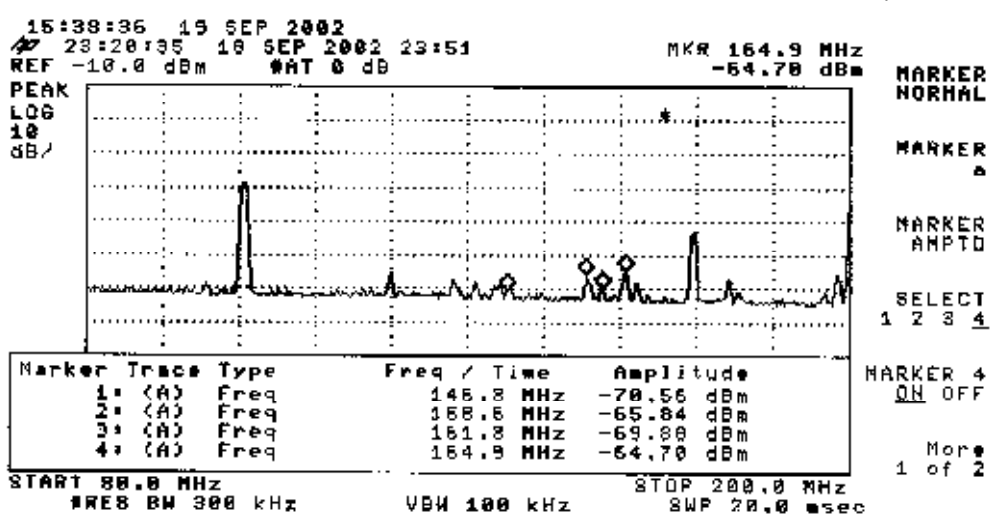
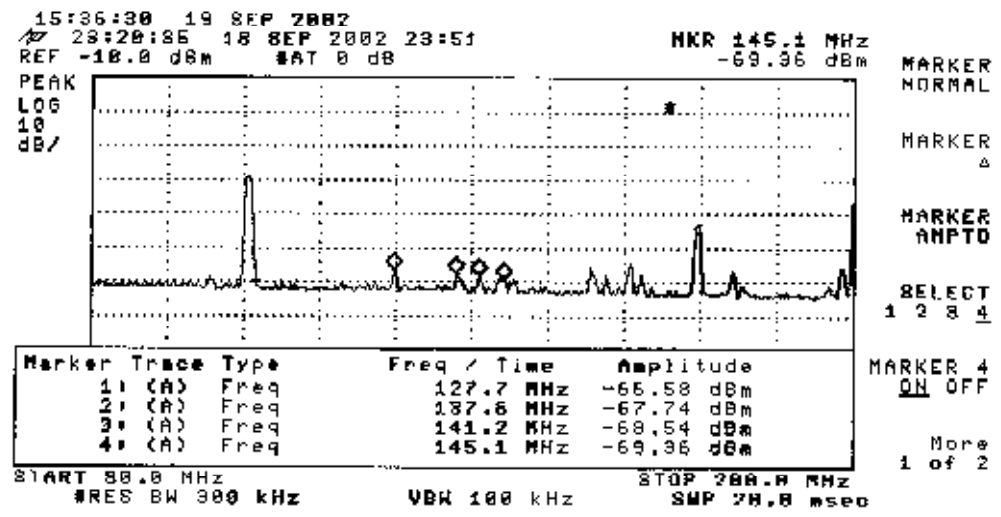
* With Feed at focus the RFI levels comes down by 14 dB

Plot VI: * 30:1 Recording shows the same RFI as C-12 Antenna with no additional components. Hence Saturation at Common box is most unlikely

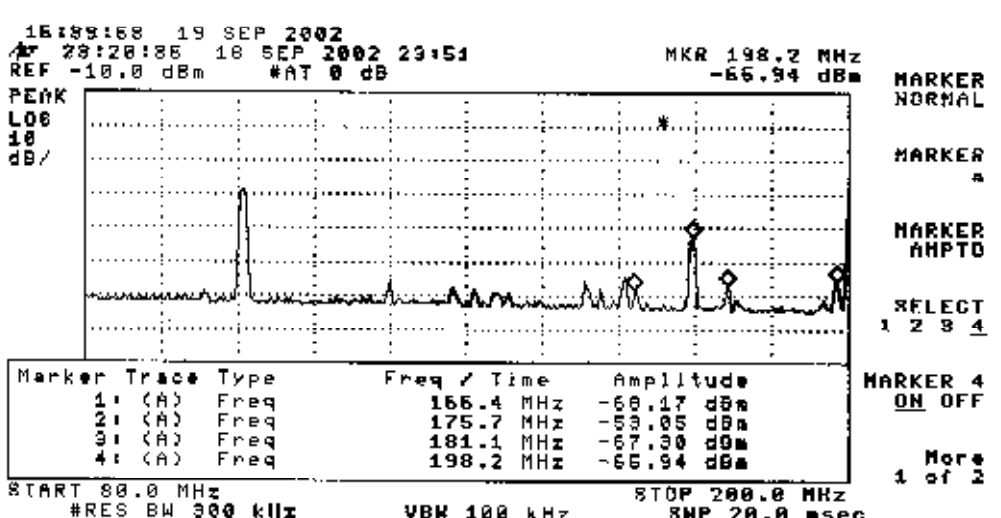
* The clean band is also the same as recorded in C-12 Antenna.

Plot V

CS
18A



CS
18A



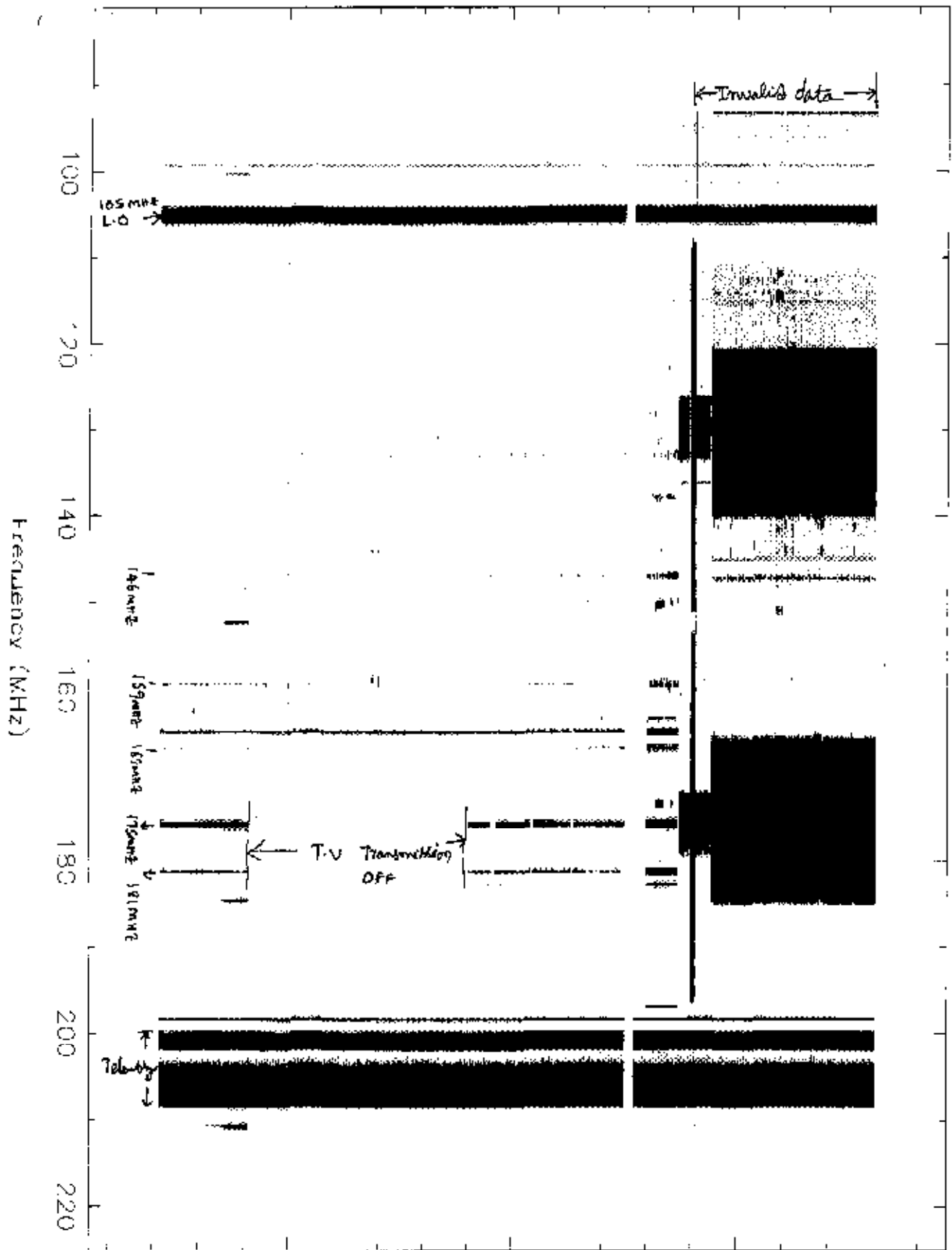
CS
18A

Time Of Day (Hr)

25

30

35



AN 005 Wed Sep 18 2002H

SOI antenna - 18th Sep. 2002

Experimental Setup & Conclusion

ON 150MHz RFI

System Set-up

Servo: Az angle = 0° , Elevation = 90°

FPS: ~~60~~¹⁵⁰ MHz feed at focus.

F.E: Same as C-5 Setting.

Experiment started at $\approx 20:30$ on 18/9/2002 & ended at 17.00 19/9/2002

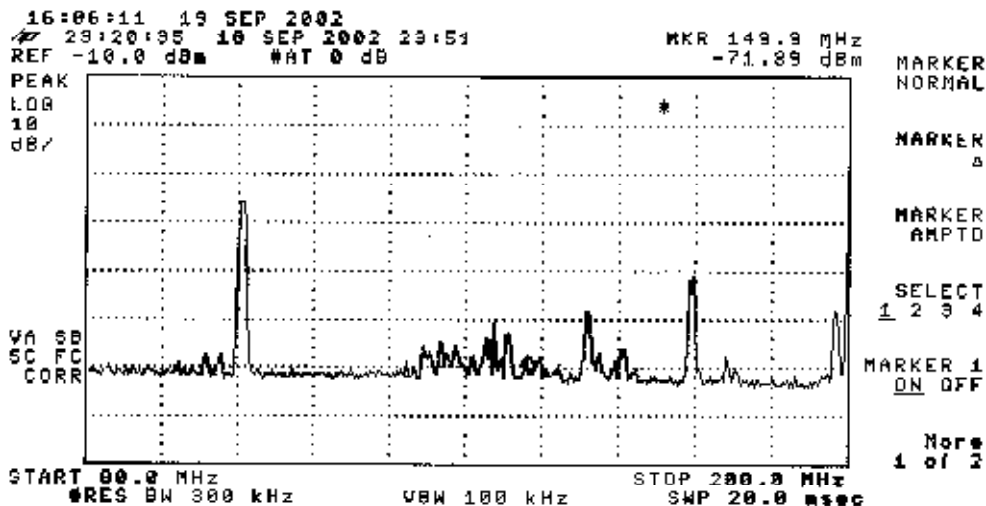
Enclosures: Plot VII taken at Rx Room at OF Monitor Port.

Plot VIII 30:1 Recording.

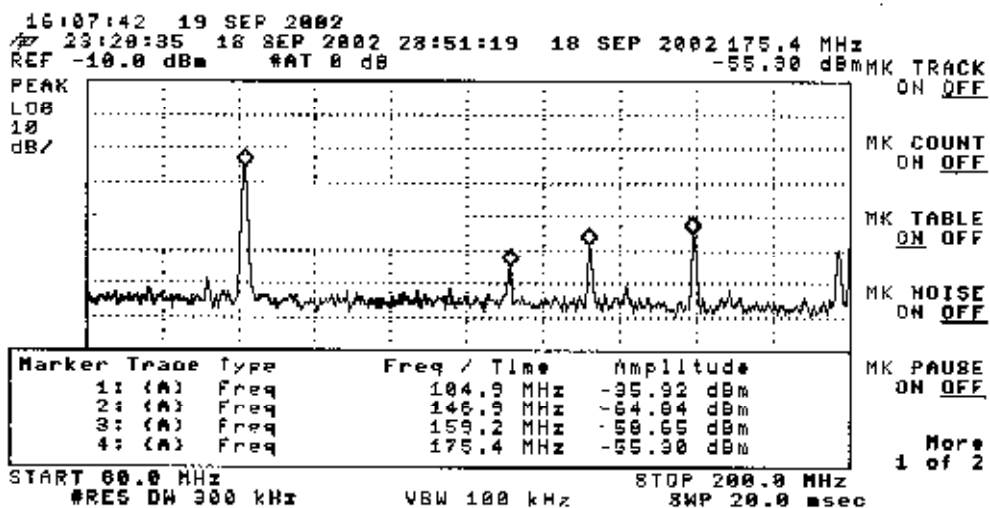
Conclusion:

Plot VII: The clean band at F.Em's output is same as C-12, & C-5 observation.

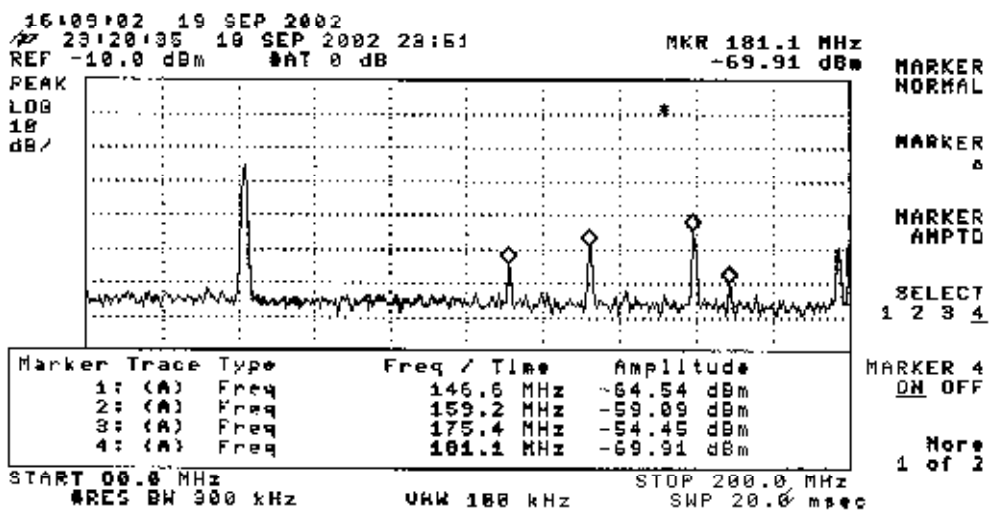
Plot VIII: The clean band is same as C-12 & C-5 recording.
Hence antenna SOI also confirms the clean band width available at 150MHz.



S1
19A



S1
20A



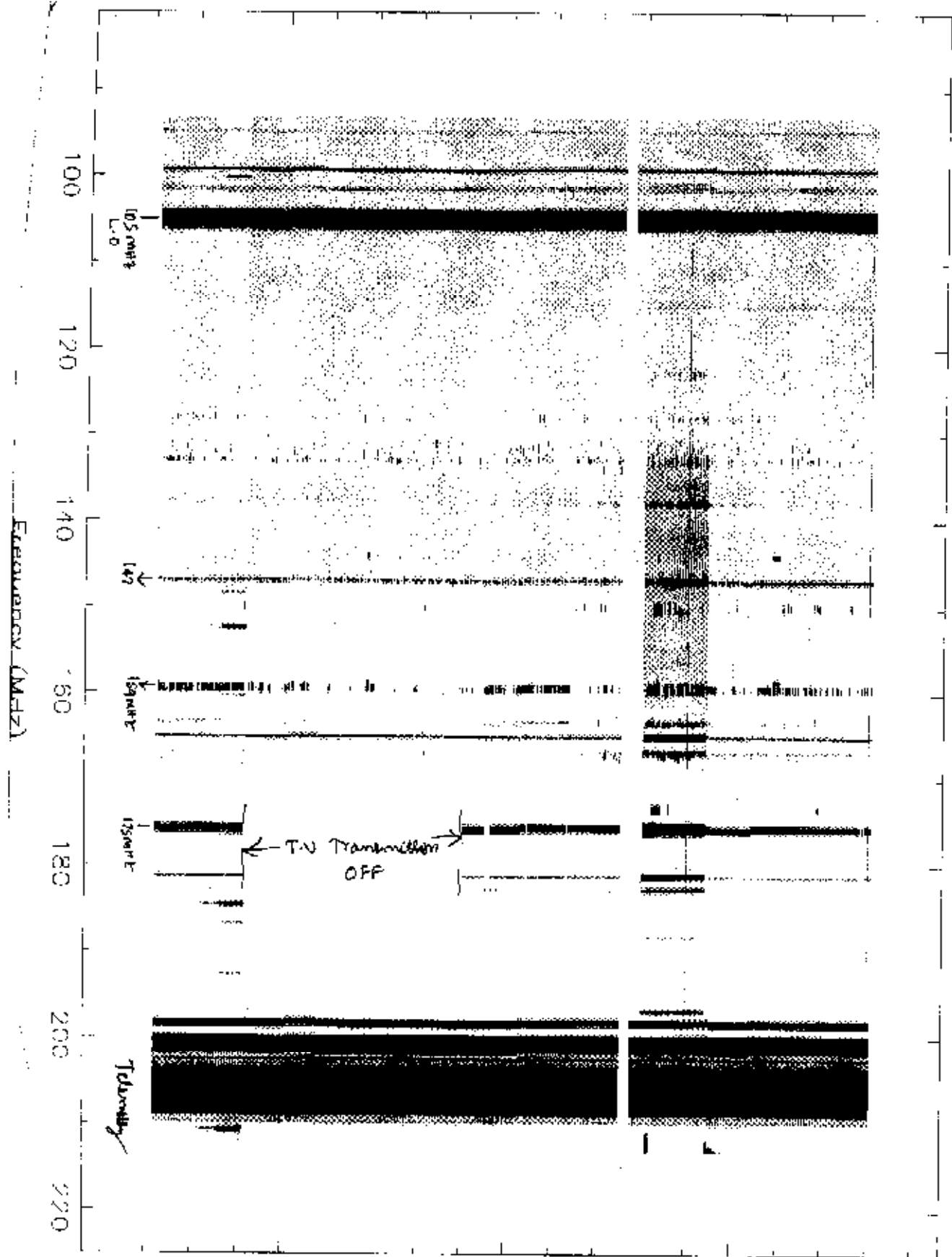
S1
21A

Time Of Day (-hr)

25

30

35



ANT S01 Wed Sep 16 2002E1

Tidning

S-02 Antenna - 18th Sep. 2002

Experimental Setup & Conclusion

on 150 MHz RFI

System Set-up

Servo: Az angle 0° , Elevation = 90°

FPS: 150 MHz Feed focus.

F.Freq: 150 MHz Selected, 150 MHz ~~full~~ F.Freq System includes with Solar attenuator = 14 dB.

I.F : I.F = 32 MHz B.W.
I.F attn: $\Rightarrow 18 + 18$ dB
I.F 130 MHz \Rightarrow ALC OFF
I.F 175 MHz \Rightarrow ALC ON
R.F Selected \Rightarrow 150 MHz
L.O \Rightarrow 220 MHz.

20.30 hrs 18/9/2002 to
 \approx 10.00 hrs 19/9/2002.

I.F : * I.F = 16 MHz B.W
I.F attn = $18 + 18$ dB
130 MHz \Rightarrow ALC OFF
175 MHz \Rightarrow ALC ON

10.22 hrs 19/9/2002 to
12.00 19/9/2002.

III I.F

* I.F = 6 MHz B.W.
* NO 30:1 Recording done.

14.00 hrs to 15.00 hrs.

* R.F Selected \Rightarrow 153 MHz
L.O Selected \Rightarrow 223 MHz } Clean band observed.

Enclosures: Plot IX I.F = 32 MHz B.W } R.F Selected = 150 MHz
 Plot X I.F = 16 MHz B.W }
 Plot XI I.F = 6 MHz B.W } R.F Selected = 153 MHz
 Plot XII 30:1 Recording.

Conclusion:

- * The Plots with 32 MHz I.F & 16 MHz I.F show lines out of which some are not present in F.F. o/p.
- * The 30:1 recording shows presence of strange lines which are not present in R.F input.
- ** I.F System ^{Setting} Saturation ~~possibility~~ Observed. Needs further study to establish it.
- ** I.F = 6 MHz show less lines in Plot XI but there are periodic lines with 120 kHz to 150 kHz equal spacing. Needs further study.

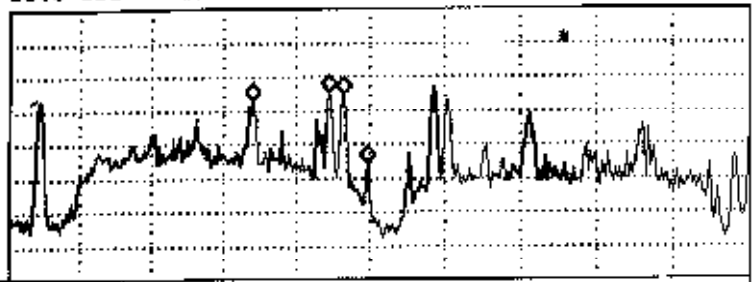
Plot 1A

S2
25A

16:16:50 19 SEP 2002
20:20:25 18 SEP 2002 23:51
REF -10.0 dBm #AT 0 dB

MKR 149.8 MHz
-65.98 dBm

PEAK
100
10
dB/



MARKER NORMAL
MARKER A
MARKER AMPTD
SELECT 1 2 3 4

Marker	Trace	Type	Freq / Time	Amplitude
1	(A)	Freq	134.0 MHz	-87.06 dBm
2	(A)	Freq	144.5 MHz	-84.30 dBm
3	(A)	Freq	146.5 MHz	-85.92 dBm
4	(A)	Freq	149.8 MHz	-65.98 dBm

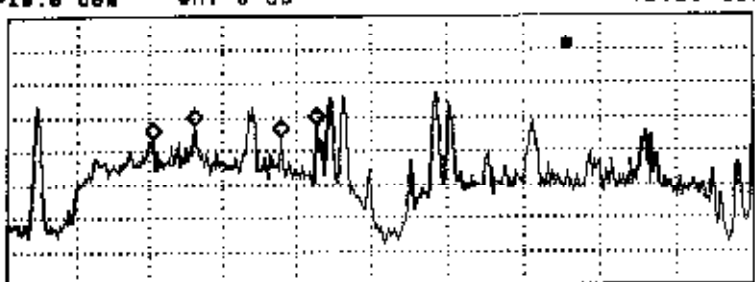
MARKER 4 ON OFF
More 1 of 2

CENTER 150.0 MHz SPAN 100.0 MHz
#RES BW 300 kHz VBW 100 kHz SWP 20.0 msec

16:17:27 19 SEP 2002
20:20:25 18 SEP 2002 23:51
REF -10.0 dBm #AT 0 dB

MKR 142.8 MHz
-42.29 dBm

PEAK
100
10
dB/



MARKER NORMAL
MARKER A
MARKER AMPTD
SELECT 1 2 3 4

Marker	Trace	Type	Freq / Time	Amplitude
1	(A)	Freq	120.5 MHz	-46.74 dBm
2	(A)	Freq	126.0 MHz	-42.52 dBm
3	(A)	Freq	138.0 MHz	-45.09 dBm
4	(A)	Freq	142.8 MHz	-42.29 dBm

MARKER 4 ON OFF
More 1 of 2

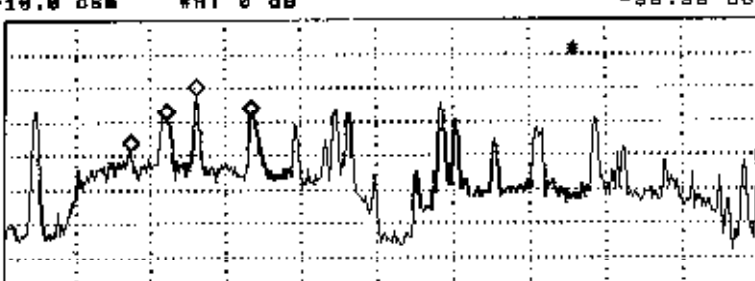
CENTER 150.0 MHz SPAN 100.0 MHz
#RES BW 300 kHz VBW 100 kHz SWP 20.0 msec

S2
25A

16:18:48 19 SEP 2002
20:20:25 18 SEP 2002 23:51
REF -10.0 dBm #AT 0 dB

MKR 138.5 MHz
-38.88 dBm

PEAK
100
10
dB/



MARKER NORMAL
MARKER A
MARKER AMPTD
SELECT 1 2 3 4

Marker	Trace	Type	Freq / Time	Amplitude
1	(A)	Freq	117.5 MHz	-40.00 dBm
2	(A)	Freq	122.3 MHz	-39.64 dBm
3	(A)	Freq	126.3 MHz	-32.25 dBm
4	(A)	Freq	138.5 MHz	-38.88 dBm

MARKER 4 ON OFF
More 1 of 2

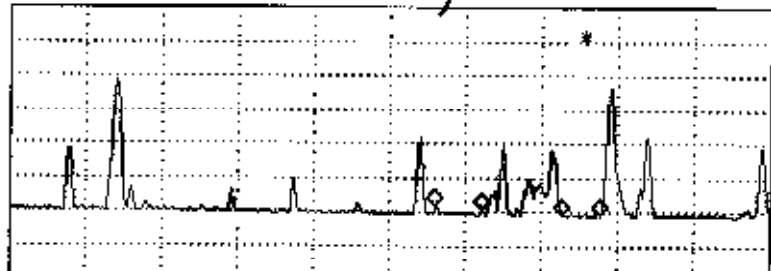
CENTER 150.0 MHz SPAN 100.0 MHz
#RES BW 300 kHz VBW 100 kHz SWP 20.0 msec

S2
26A

16:26:40 19 SEP 2002
14:12:09 19 SEP 2002
REF -20.0 dBm AT 10 dB

MKR 174.4 MHz
-80.96 dBm

PEAK
LOG
10
dB/



MARKER
NORMAL
MARKER
▲
MARKER
AMPTD
SELECT
1 2 3 4

Marker	Trace	Type	Freq / Time	Amplitude
1:	(A)	Freq	149.4 MHz	-78.28 dBm
2:	(A)	Freq	166.6 MHz	-79.60 dBm
3:	(A)	Freq	168.7 MHz	-80.94 dBm
4:	(A)	Freq	174.4 MHz	-80.96 dBm

MARKER 4
ON OFF
More
1 of 2

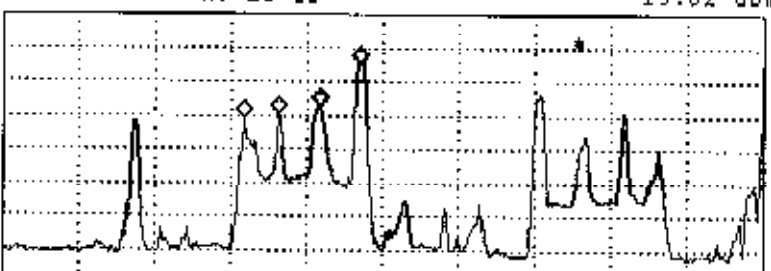
START 85.0 MHz #RES BW 300 kHz #VBW 3 kHz STOP 200.0 MHz SMP 383 msec

30A
C12
Mux hold.

16:20:10 19 SEP 2002
14:12:09 19 SEP 2002 14:11:
REF -5.0 dBm AT 10 dB

MKR 199.1 MHz
-19.82 dBm

PEAK
LOG
10
dB/



MARKER
NORMAL
MARKER
▲
MARKER
AMPTD
SELECT
1 2 3 4

Marker	Trace	Type	Freq / Time	Amplitude
1:	(A)	Freq	121.5 MHz	-85.66 dBm
2:	(A)	Freq	126.7 MHz	-84.83 dBm
3:	(A)	Freq	193.0 MHz	-82.64 dBm
4:	(A)	Freq	199.1 MHz	-19.82 dBm

MARKER 4
ON OFF
More
1 of 2

START 85.0 MHz #RES BW 300 kHz #VBW 3 kHz STOP 200.0 MHz SMP 383 msec

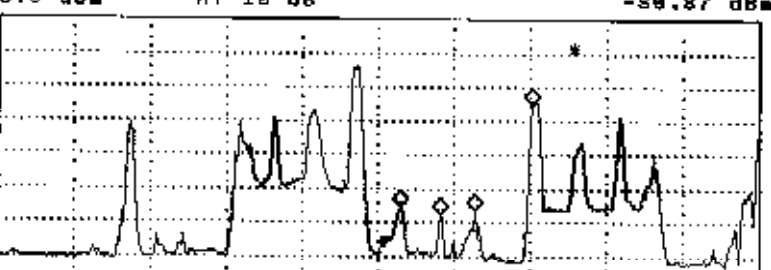
31A
S2
130 ALL OFF
175 ALL ON
16mV

~~PLOT X~~

16:29:30 19 SEP 2002
14:12:09 19 SEP 2002 14:11:
REF -5.0 dBm AT 10 dB

MKR 165.8 MHz
-88.87 dBm

PEAK
LOG
10
dB/



MARKER
NORMAL
MARKER
▲
MARKER
AMPTD
SELECT
1 2 3 4

Marker	Trace	Type	Freq / Time	Amplitude
1:	(A)	Freq	146.0 MHz	-68.21 dBm
2:	(A)	Freq	152.0 MHz	-62.68 dBm
3:	(A)	Freq	157.2 MHz	-61.46 dBm
4:	(A)	Freq	165.8 MHz	-88.87 dBm

MARKER 4
ON OFF
More
1 of 2

START 85.0 MHz #RES BW 300 kHz #VBW 3 kHz STOP 200.0 MHz SMP 383 msec

31A
S2

16:51:58 19 SEP 2002
 14:12:09 19 SEP 2002 14:14
 REF -6.0 dBm AT 10 dB

MKR 178.3 MHz
 -42.07 dBm



Marker	Trace	Type	Freq / Time	Amplitude
1	(A)	Freq	121.8 MHz	-43.87 dBm
2	(A)	Freq	126.7 MHz	-35.35 dBm
3	(A)	Freq	182.7 MHz	-33.14 dBm
4	(A)	Freq	178.3 MHz	-42.07 dBm

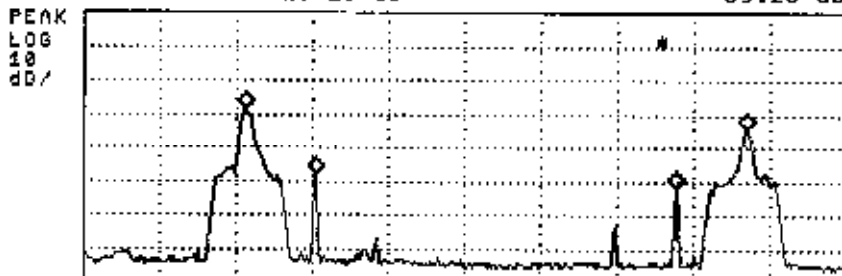
START 85.0 MHz STOP 200.0 MHz
 #RES BW 300 kHz #VBW 3 kHz SWP 388 msec

MARKER NORMAL
 MARKER Δ
 MARKER AMPTD
 SELECT 1 2 3 4
 MARKER 4 ON OFF
 More 1 of 2

S2
 33A

16:58:54 19 SEP 2002
 14:12:09 19 SEP 2002 14:26
 REF -5.0 dBm AT 10 dB

MKR 175.98 MHz
 -89.25 dBm



Marker	Trace	Type	Freq / Time	Amplitude
1	(A)	Freq	129.88 MHz	-88.49 dBm
2	(A)	Freq	136.85 MHz	-58.85 dBm
3	(A)	Freq	169.48 MHz	-56.91 dBm
4	(A)	Freq	175.98 MHz	-89.25 dBm

CENTER 150.00 MHz SPAN 70.00 MHz
 #RES BW 100 kHz #VBW 3 kHz SWP 700 msec

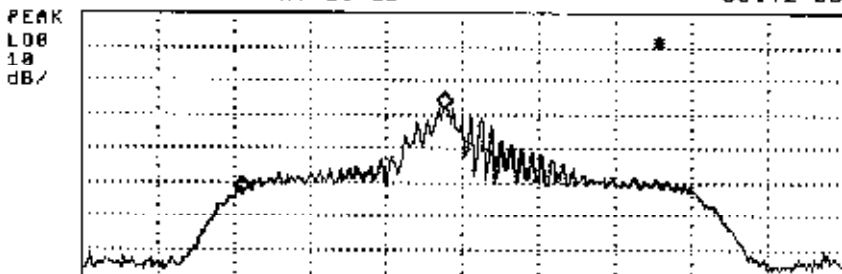
MARKER NORMAL
 MARKER Δ
 MARKER AMPTD
 SELECT 1 2 3 4
 MARKER 4 ON OFF
 More 1 of 2

S2
 38A

Plot XI

16:04:33 19 SEP 2002
 14:12:09 19 SEP 2002 14:26
 REF -5.0 dBm AT 10 dB

MKR 129.78 MHz
 -88.42 dBm



Marker	Trace	Type	Freq / Time	Amplitude
1	(A)	Freq	127.10 MHz	-58.98 dBm
2	Inactive			
3	Inactive			
4	(A)	Freq	129.78 MHz	-88.42 dBm

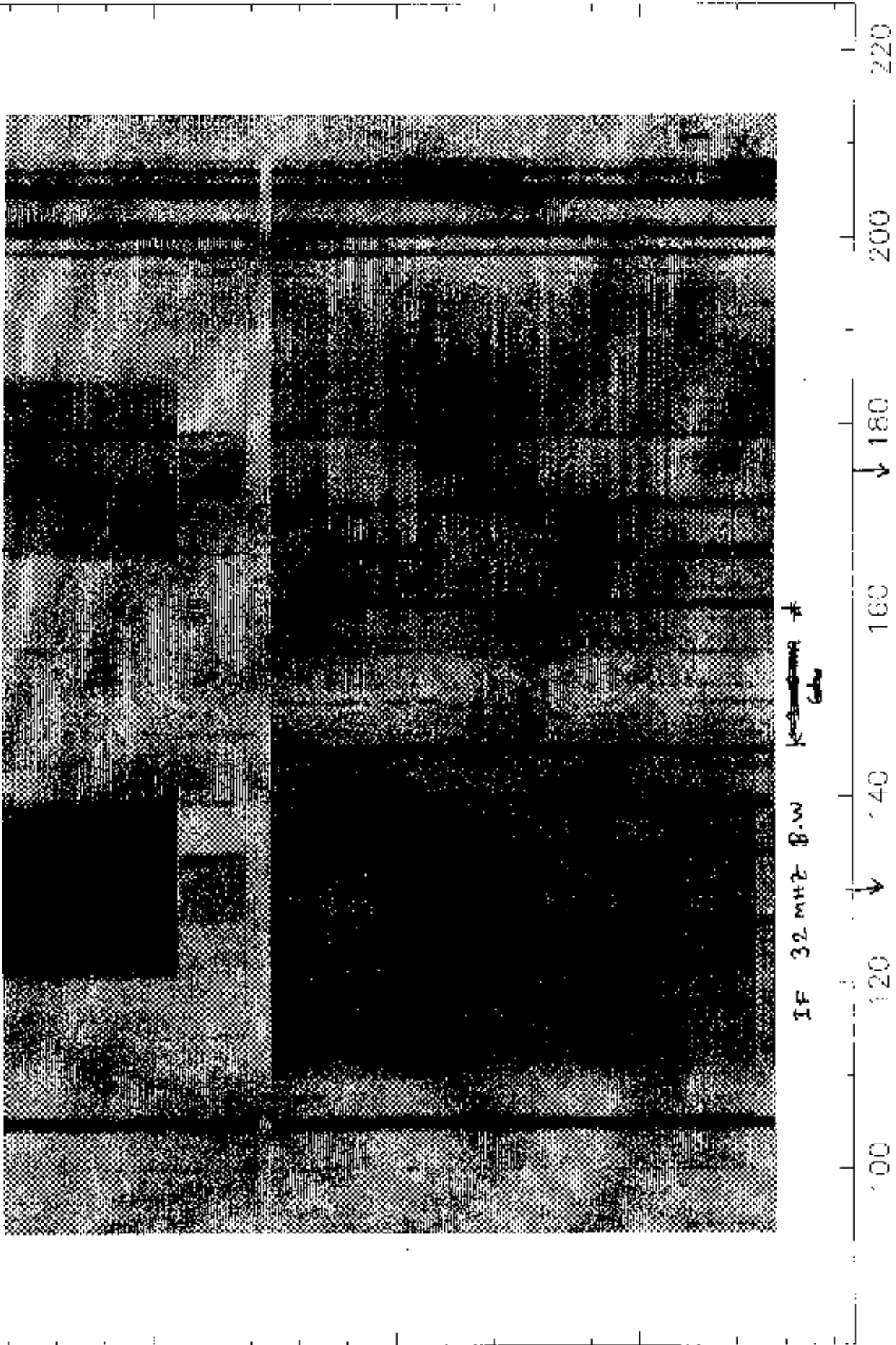
CENTER 130.00 MHz SPAN 10.00 MHz
 #RES BW 100 kHz #VBW 3 kHz SWP 100 msec

MARKER → CF
 MARKER → REF LVL
 MARKER → CF STEP
 MARKER Δ → SPAN
 MARKER → MINIMUM
 More 1 of 2

S2
 39A

ANT S02 Wed Sep 18 2002LI

IF 16 MHz B.W



35

30

25

00

120

140

160

180

200

220

IF 32 MHz B.W ~~IF 136 MHz~~ *

IF 136 MHz
IF 175 MHz
Frequency (MHz)

Final Conclusion

- * RFI at 150 MHz give a Channel Power of -07 dBm to -12 dBm at Front end Output when ISO feed is Off focus and facing South, with zero dB Solar Attn.
- * When feed focused to dish RFI drops by ≈ 14 dB down.
- * Strong RFI frequencies can be learnt from S-Analyses Plots given.
- * Possibility of ISO LNA & C: box amplifier Saturation is unlikely
- * Possibility of I-F System Saturation is high and most likely
- * Clean RFI free / less band is between
 - * ~ 134 MHz to 146 MHz clean band.
 - * 148 MHz to 157 MHz = ≈ 9 MHz B.W
 - * 169 MHz to 173 MHz = ≈ 4 MHz B.W
- * When I.F Set to ~~6~~ 6 MHz B.W with R.F Selected at 153 MHz & LO = 223 MHz. we see periodic lines in the band with equal spacing 120 kHz to 150 kHz. which is not present in R.F.
- * A Band Pass filter at above clean band will be of use for this frequency.