SEARFE Receiver Calibration

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Students
Exploring
Australia's
Radio
Frequency
Environment

www.searfe.atnf.csiro.au

What is SEARFE?

Students Exploring Australia's Radio Frequency Environment

- Program aims to give high-school students
  - Practical experience in the use of radio-frequency spectrum
  - Provide an overview of scientific objectives of next generation radio telescopes
  - Practical understanding of why these telescopes have to operate in radio-quiet areas

SEARFE Equipment

- Receiver
  - AR-3000A
  - WR-1550e
- Antenna
  - D130J Discone Antenna
- Laptop with SEARFE software

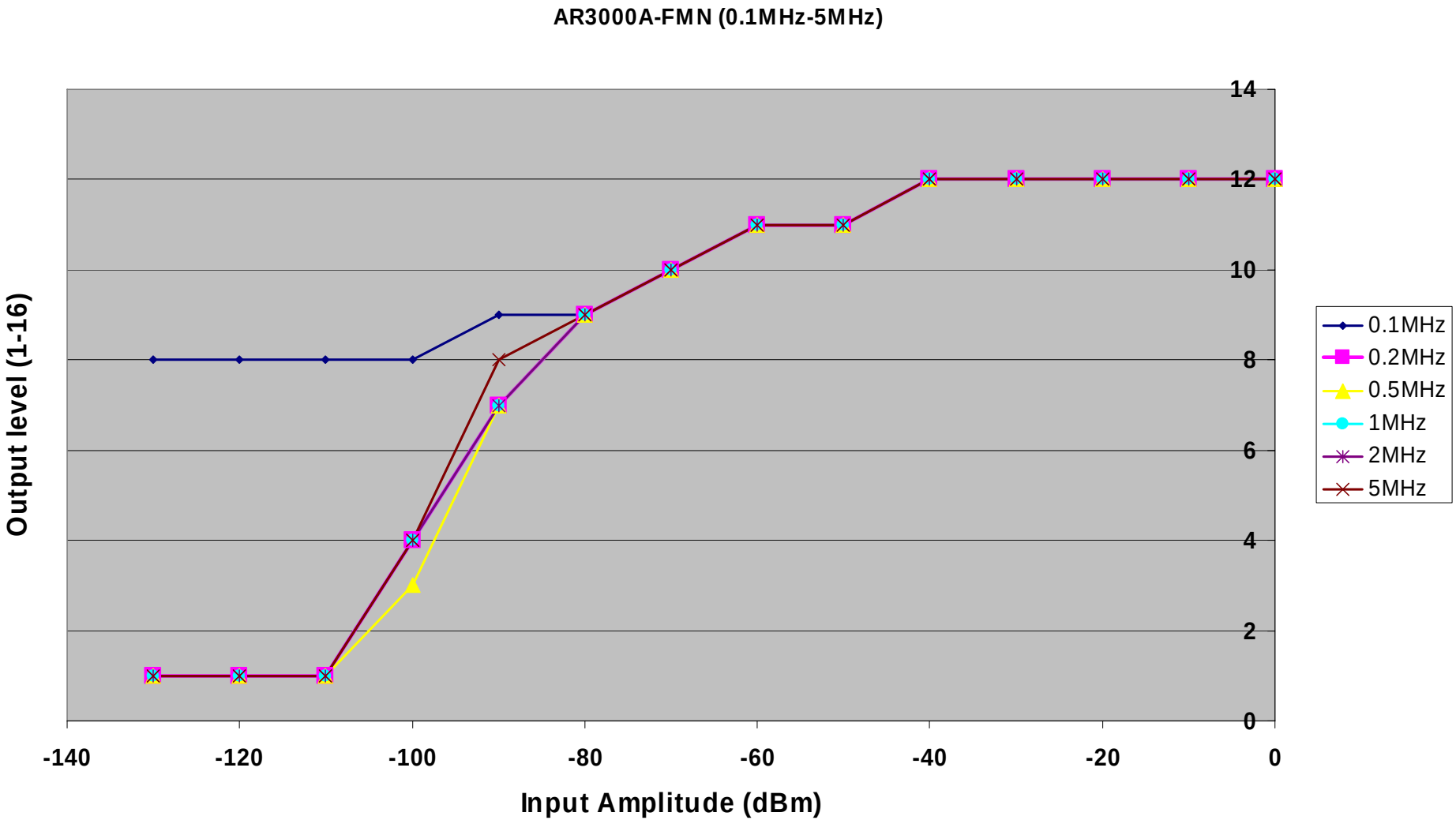
Objectives of my project

- Characterise the receivers properties
- Calibrate the two receivers
- Determine their usefulness for radio astronomy applications
- Compare the different receiver modes
- Compare the two receivers
- Analyse and calibrate some of the SEARFE data

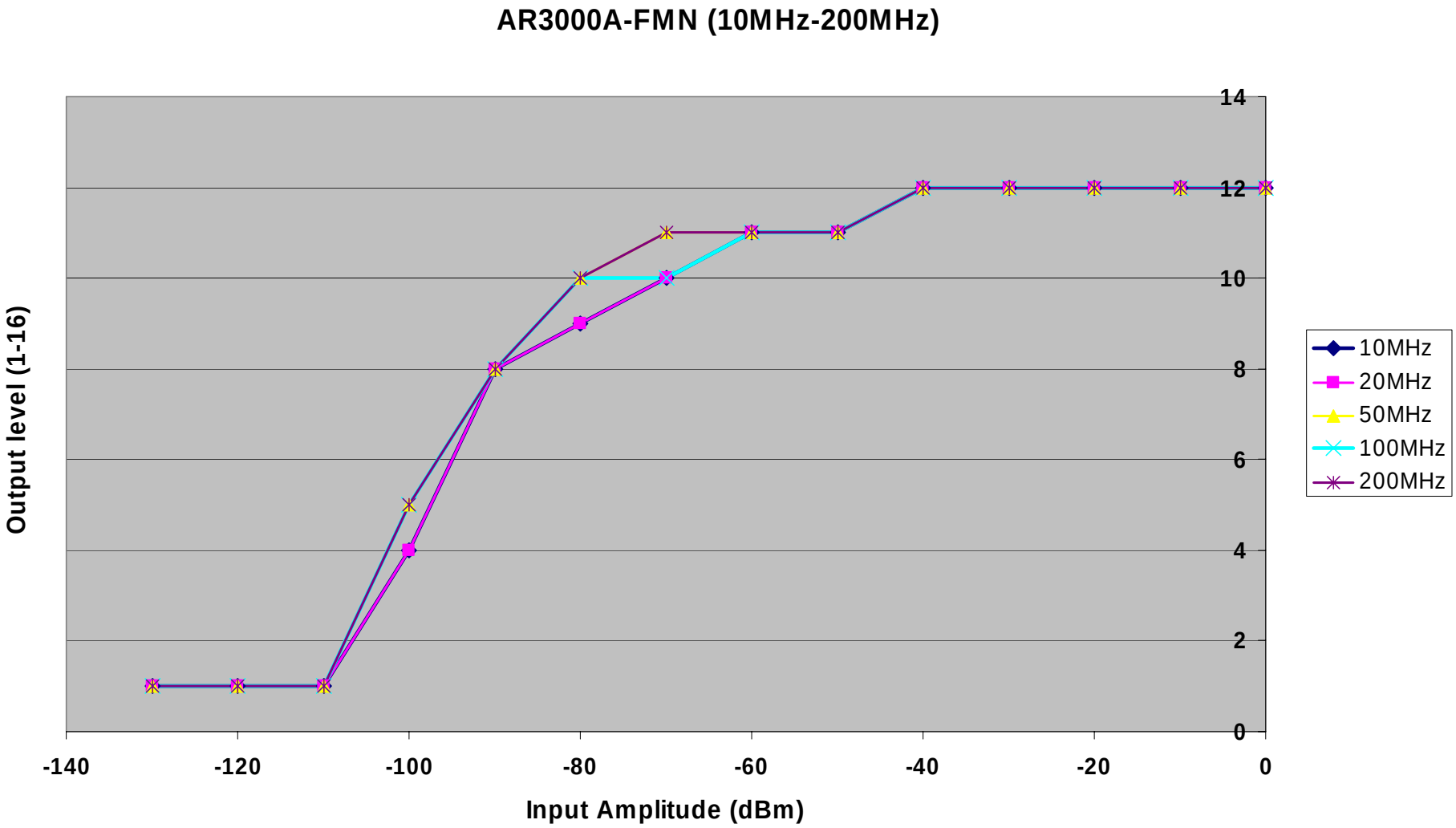
AR-3000A Overview

- Frequency Range:
  - 100kHz-2036MHz
- Receiving modes:
  - AM, WFM, NFM, USB, LSB & CW
- Output Strength indicator:
  - 16 quantisation levels (A-P)
- Receiver Selectivity
  - NFM: 12kHz/-6dB
  - WFM: 180kHz/-6dB

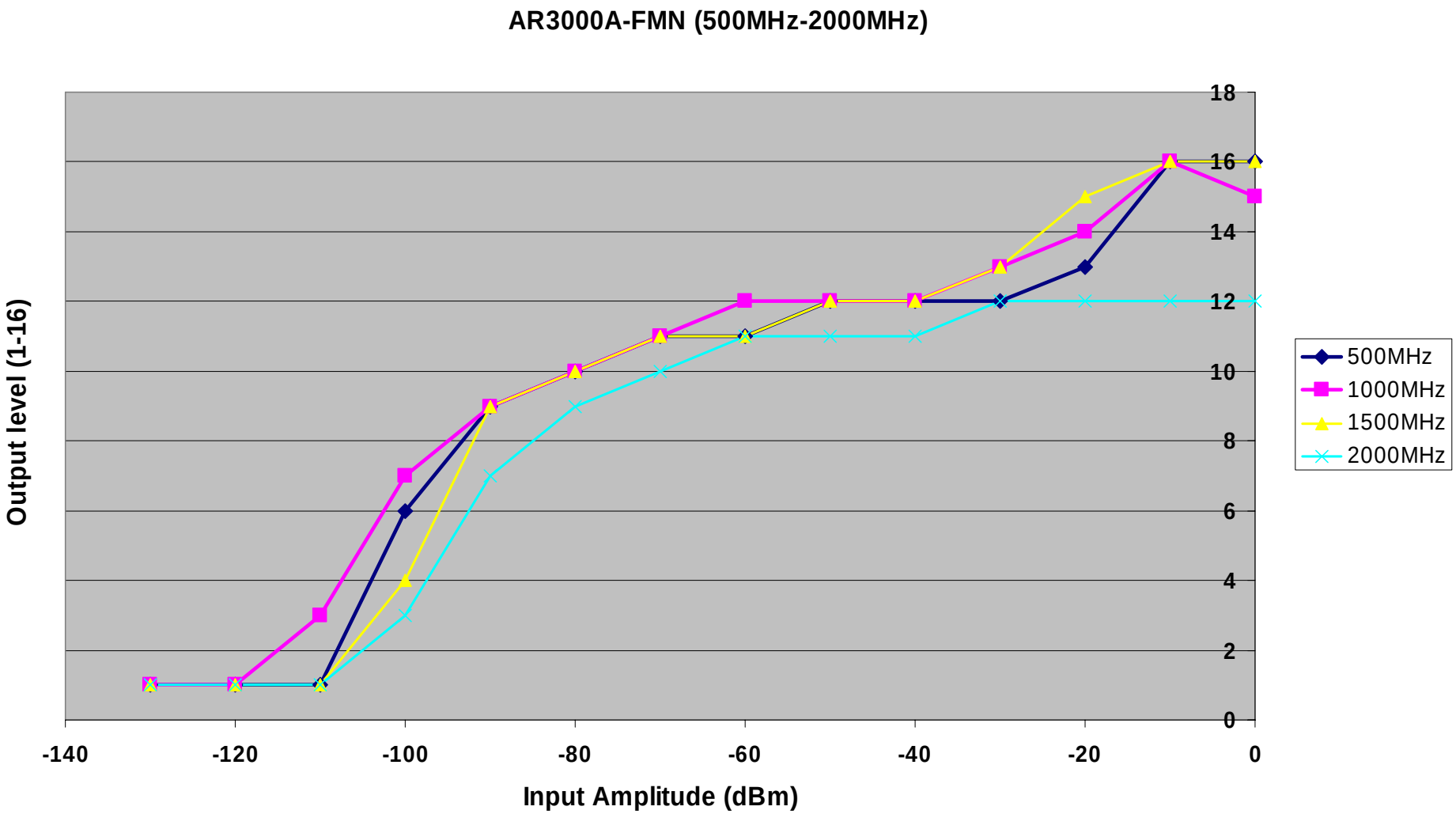
AR-3000A
NFM Low Frequencies



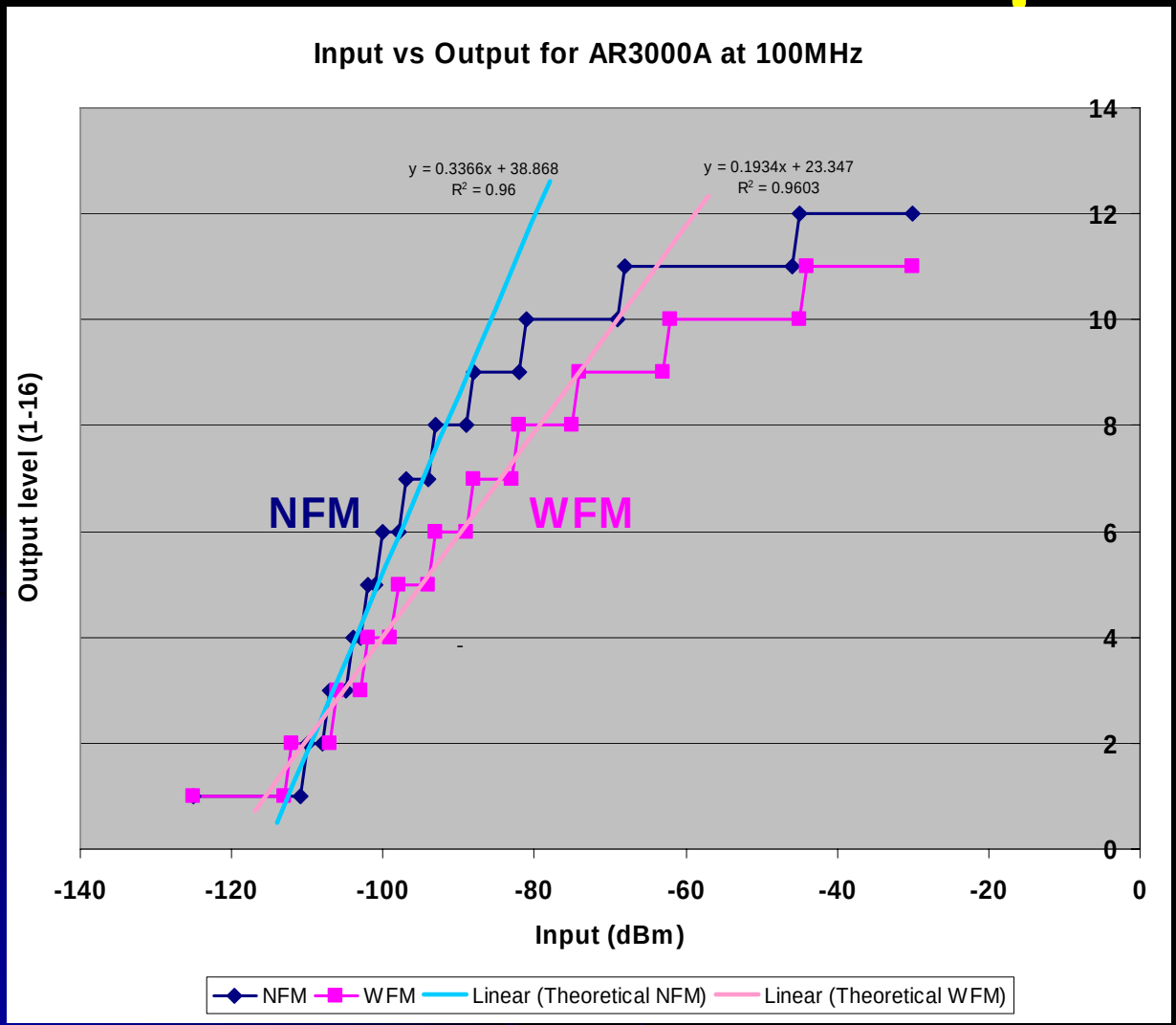
AR-3000A
NFM Middle Frequencies



AR-3000A
NFM High Frequencies

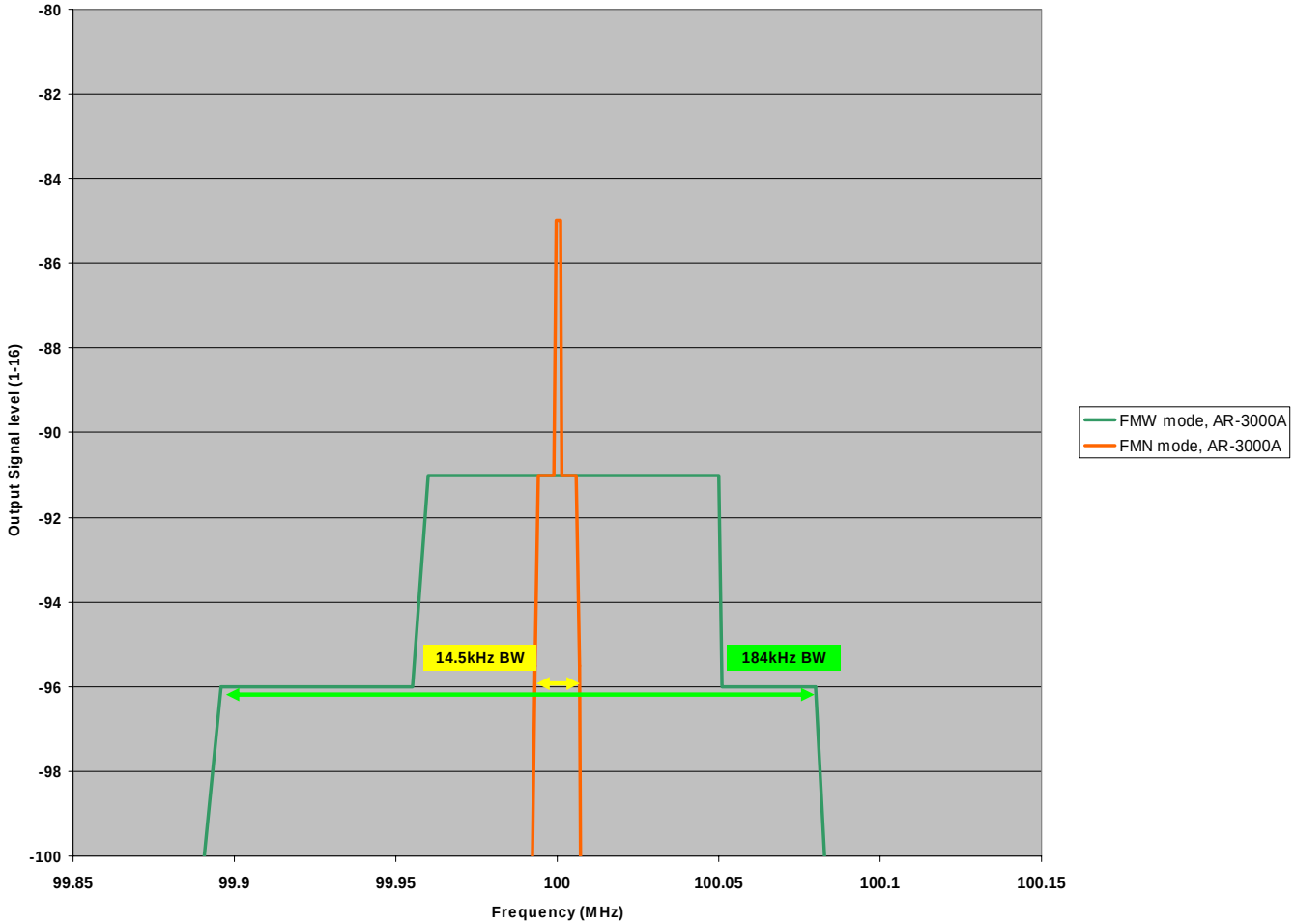


AR-3000A Calibration Technique



Raw o/p	Raw no	WFM (dBm)	NFM (dBm)
A	1	-115.8	-112.5
B	2	-109.5	-109.0
C	3	-104.5	-106.0
D	4	-100.5	-103.5
E	5	-96.0	-101.5
F	6	-91.0	-99.0
G	7	-85.5	-95.5
H	8	-78.5	-91.0
I	9	-68.5	-85.0
J	10	-53.5	-75.0
K	11	-37.0	-57.0
L	12		-37.5

AR-3000A
Selectivity Measurements



NFM Specified BW:

12kHz/-6dB

NFM Measured BW:

14.5kHz/-6dB

WFM Specified BW:

180kHz/-6dB

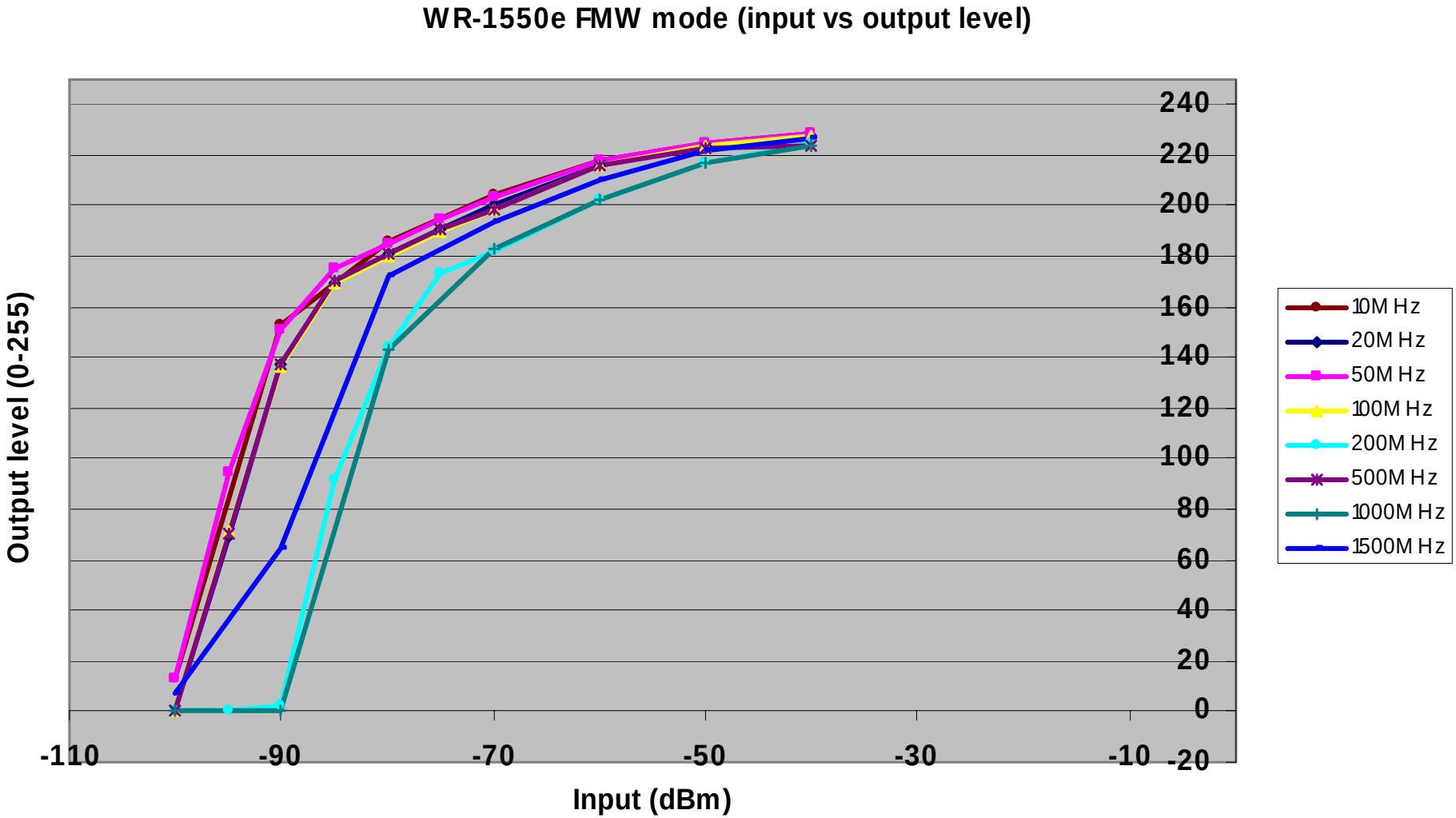
WFM Measured BW:

184kHz/-6dB

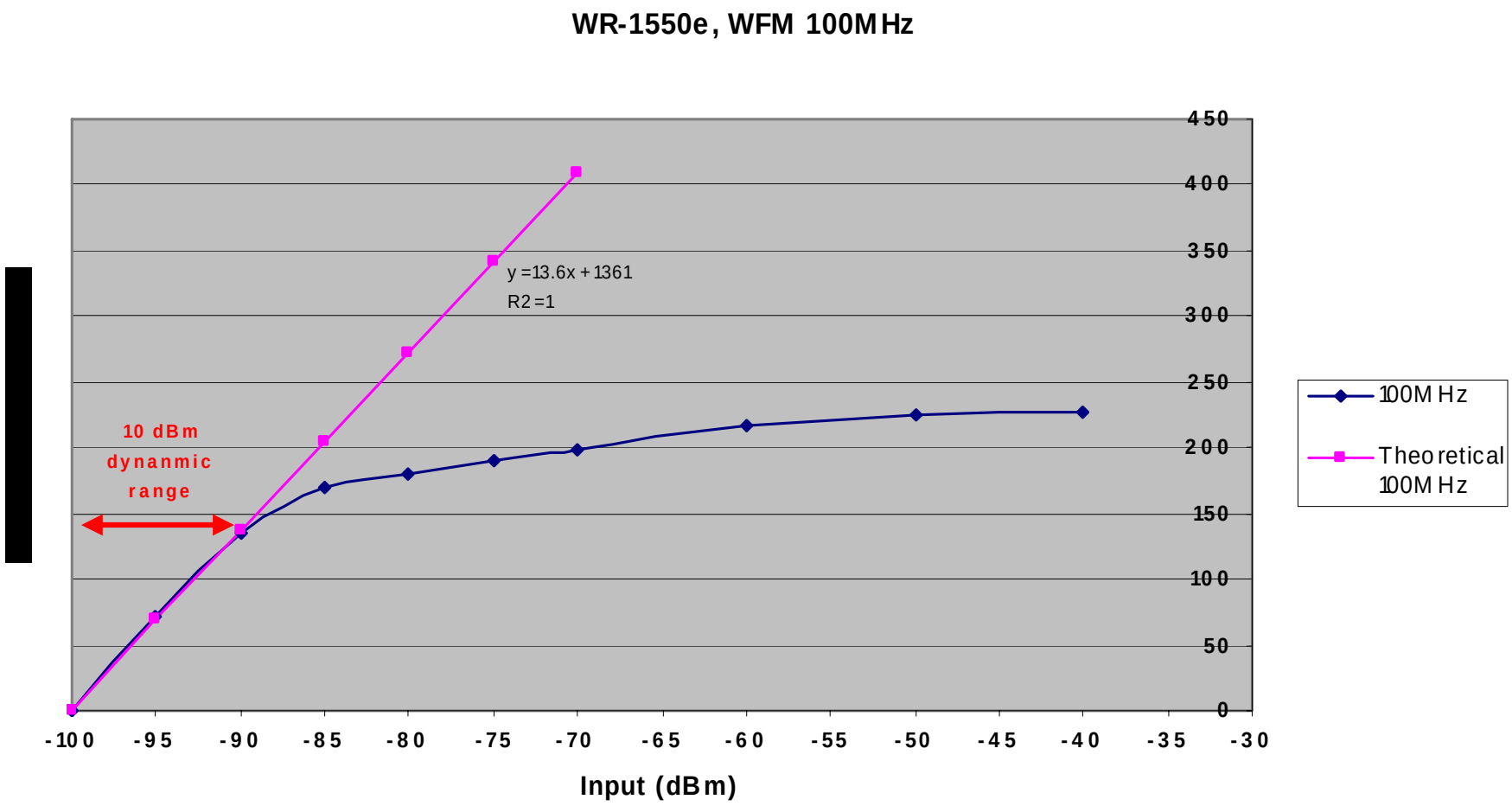
WR-1550e Characteristics

- Frequency Range:
  150kHz-1500MHz
- Receiving modes:
  AM, WFM, NFM & SSB
- Output Strength indicator:
  256 quantisation levels (0-255)
- Receiver Selectivity
  NFM: 15kHz/-6dB
  WFM: 230kHz/-6dB

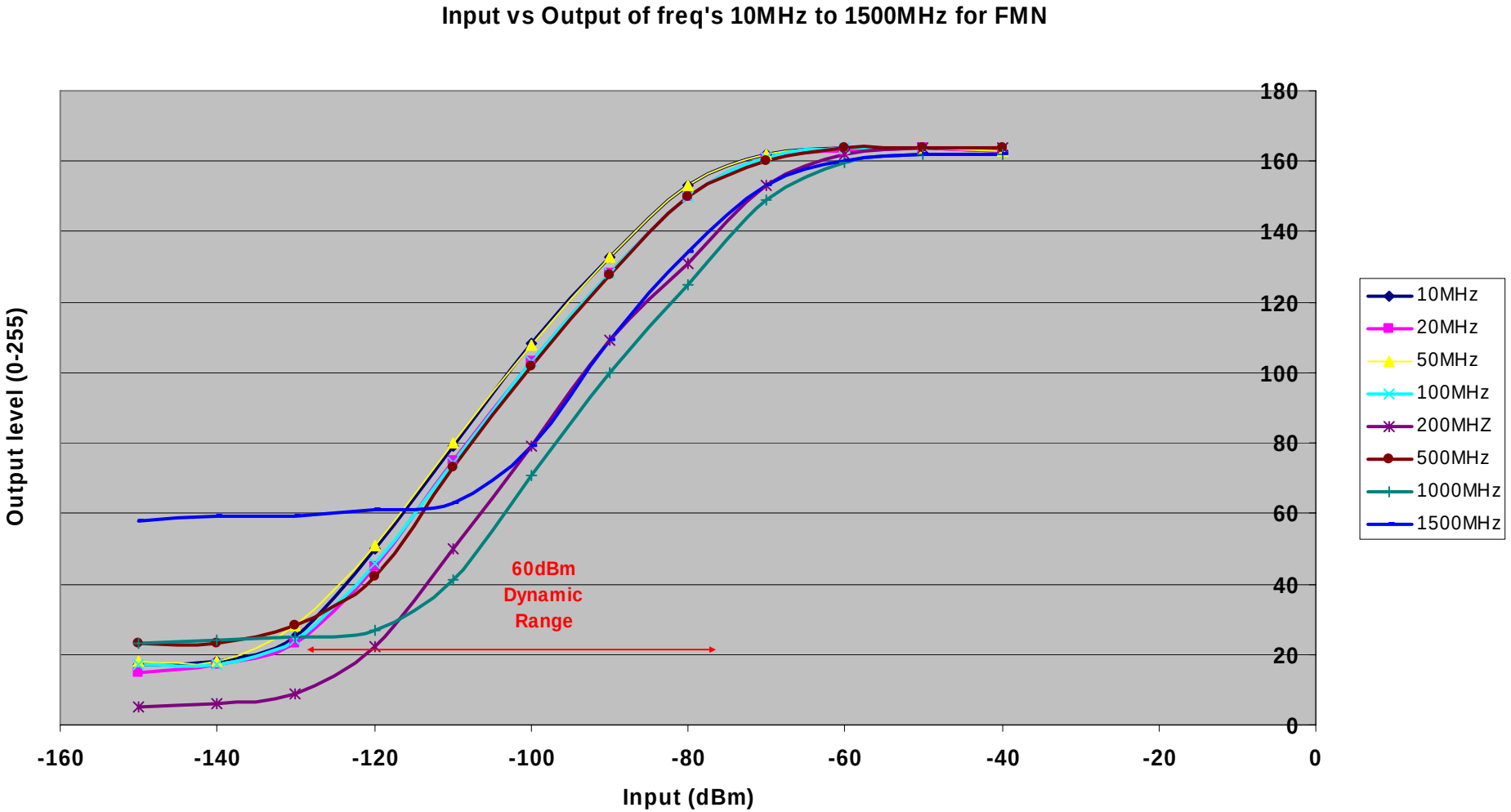
WR-1550e
WFM (10MHz-1500MHz)



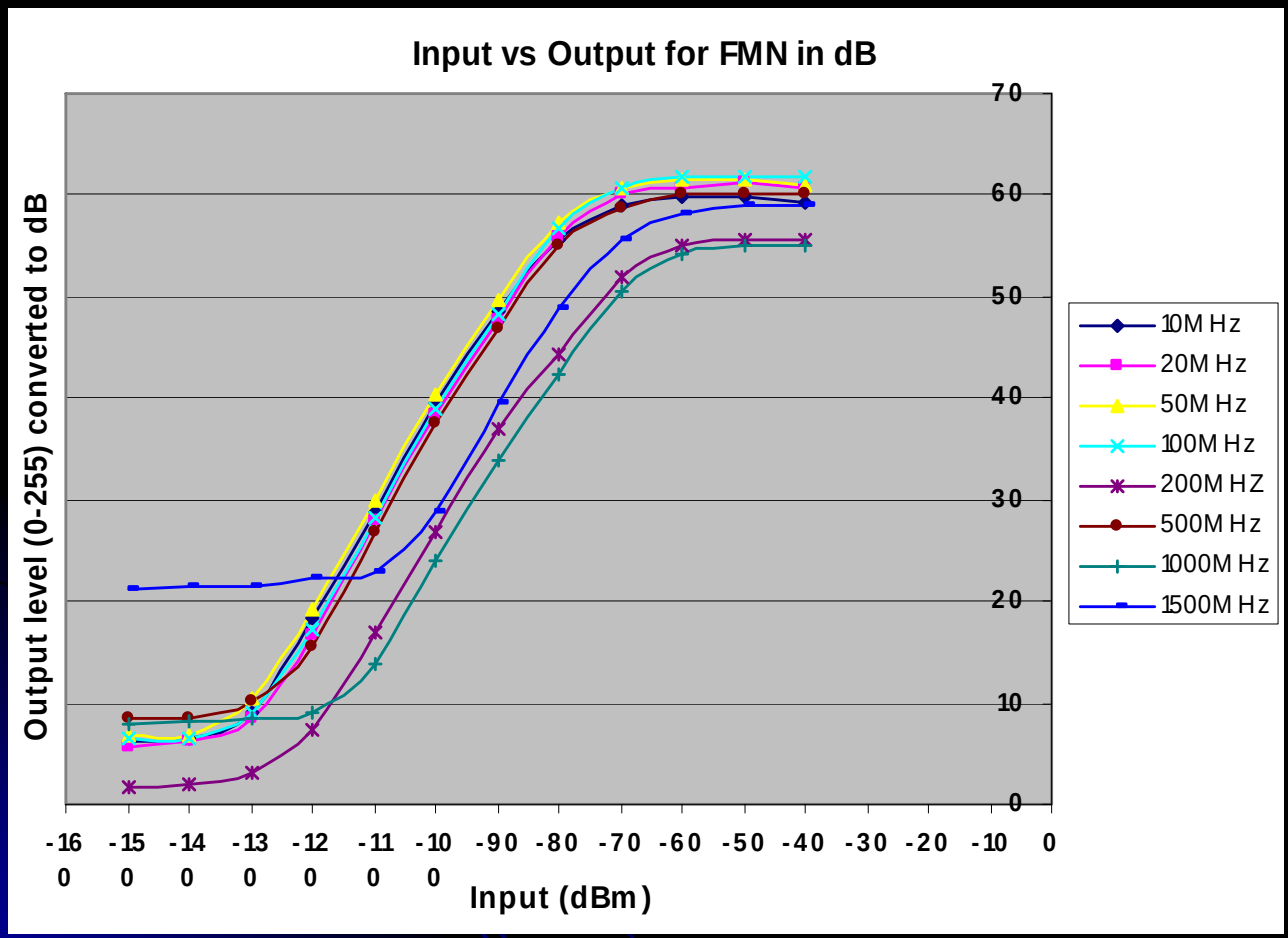
WR-1550e
WFM, 100MHz



WR-1550e
NFM (10MHz-1500MHz)

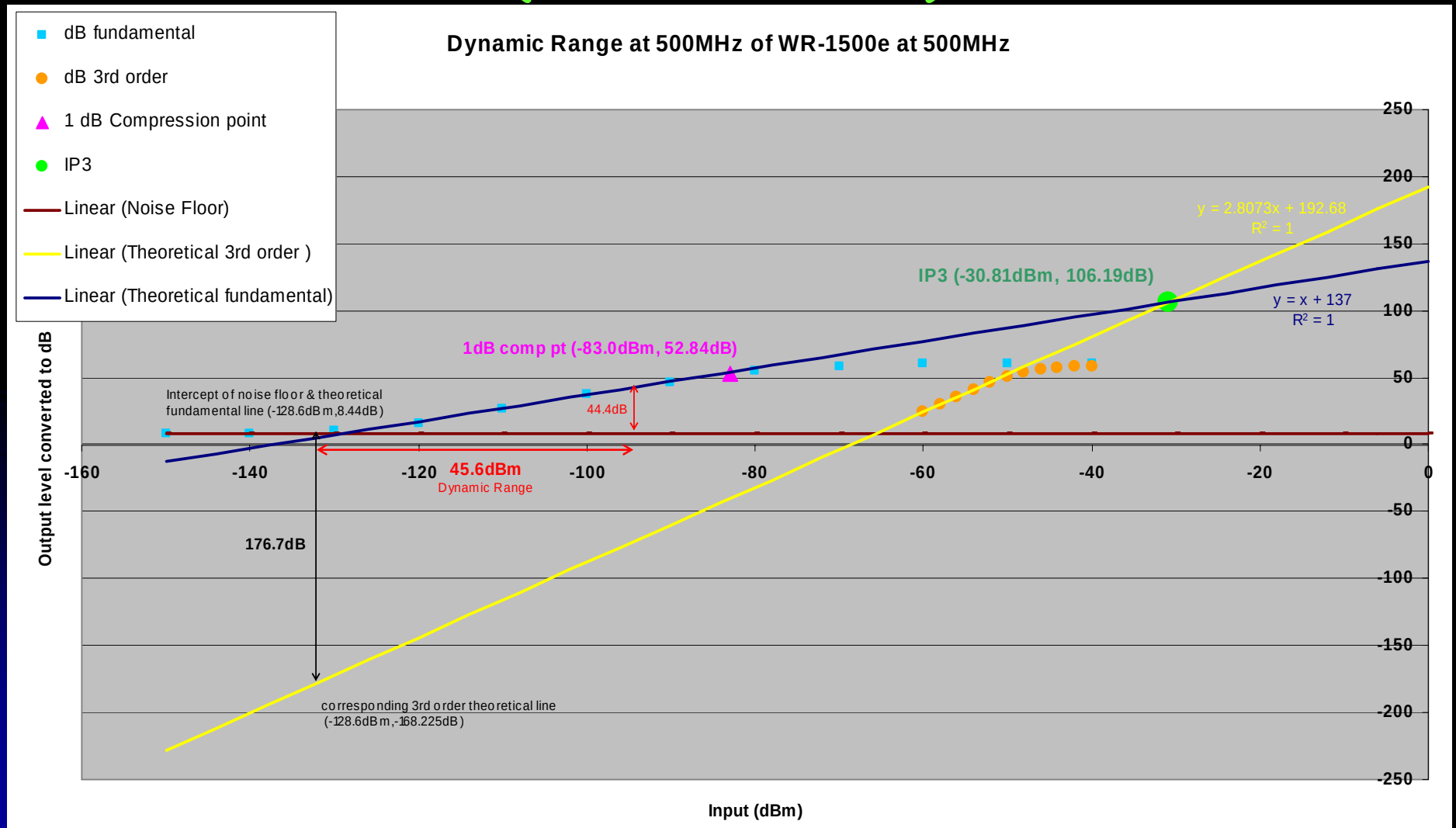


WR-1550e
Converting the Output level to dB

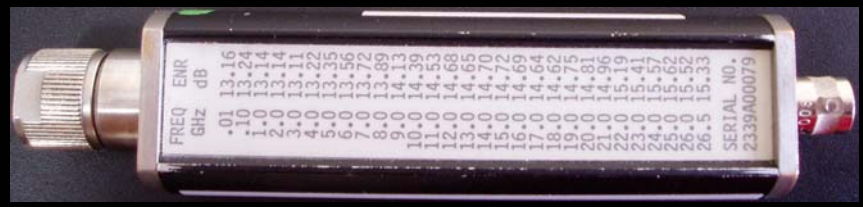


- Determine dynamic range
- Calculate 1 dB compression points
- Calculate dynamic range
- Calculate Noise Figure

WR-1550e
FMN 3rd point Intercept
(NFM 500MHz)



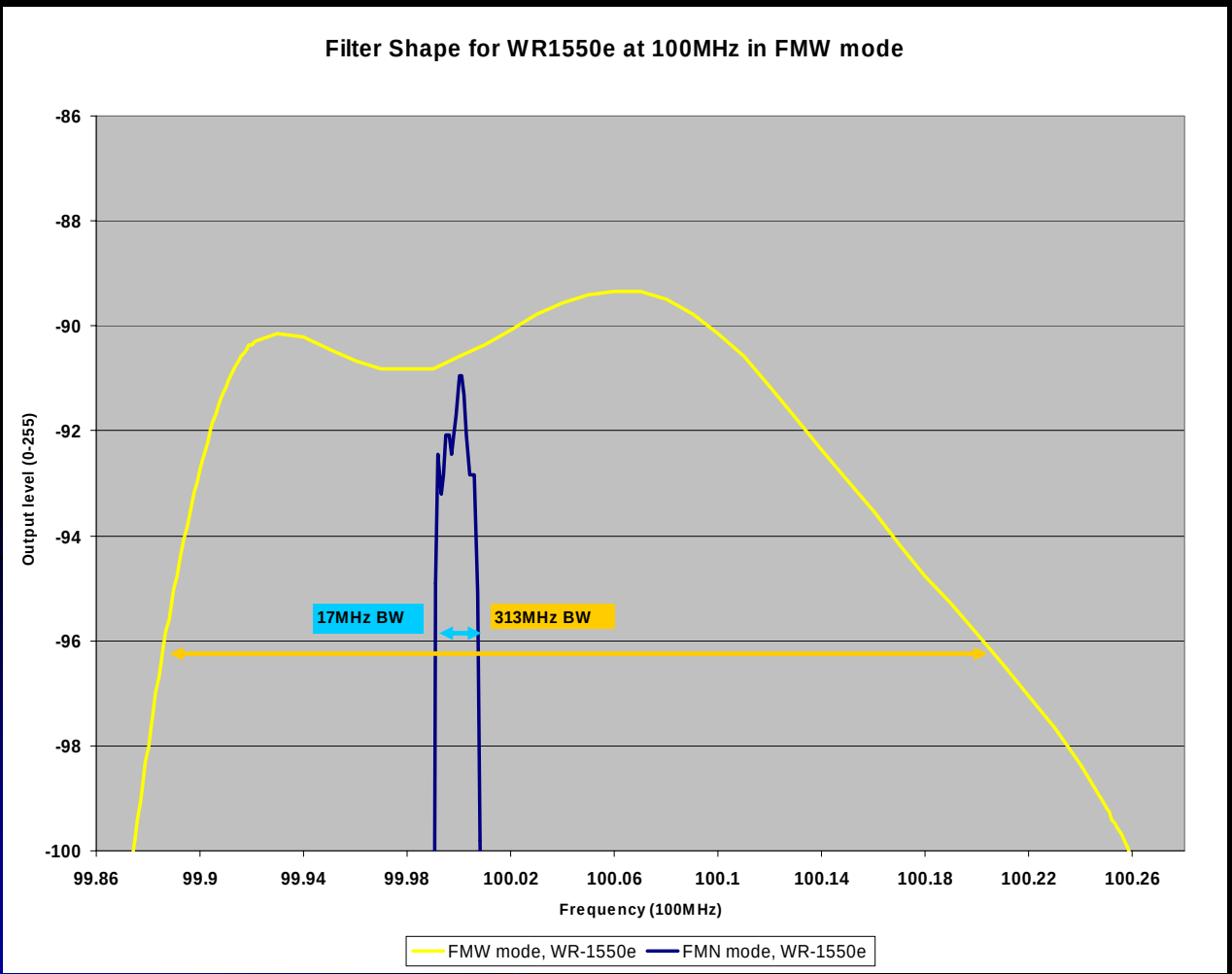
WR-1550e Noise Figure Measurements



- Measured with a 346C Noise Source
  - At 10MHz, 100MHz & 1000MHz

Frequency (MHz)	10	100	1000
Noise Figure (dB)	6.11±4	7.95±6.7	9.91±4
Noise Temperature (K)	894±565	1519±1288	2549±1039

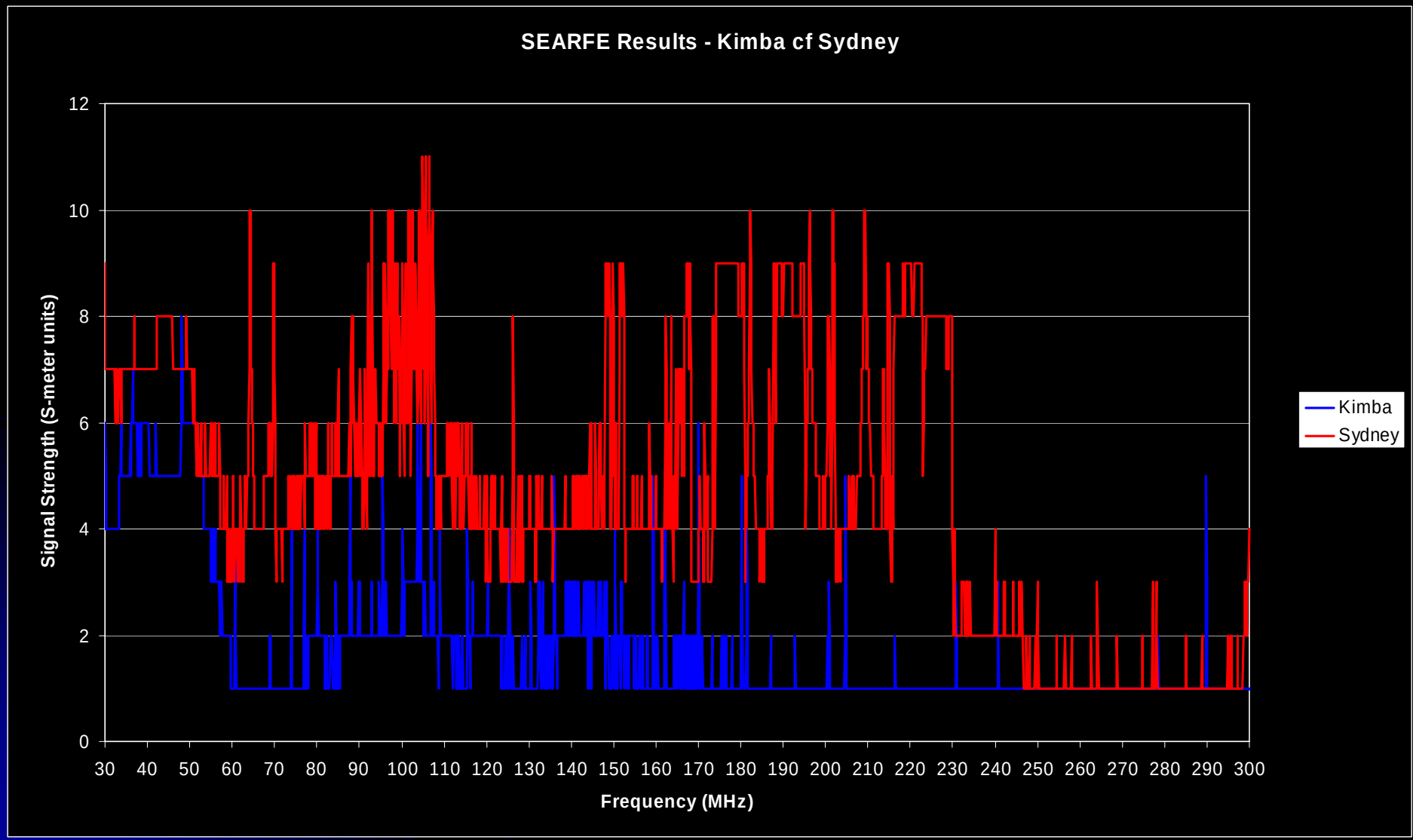
WR-1550e Selectivity Measurements



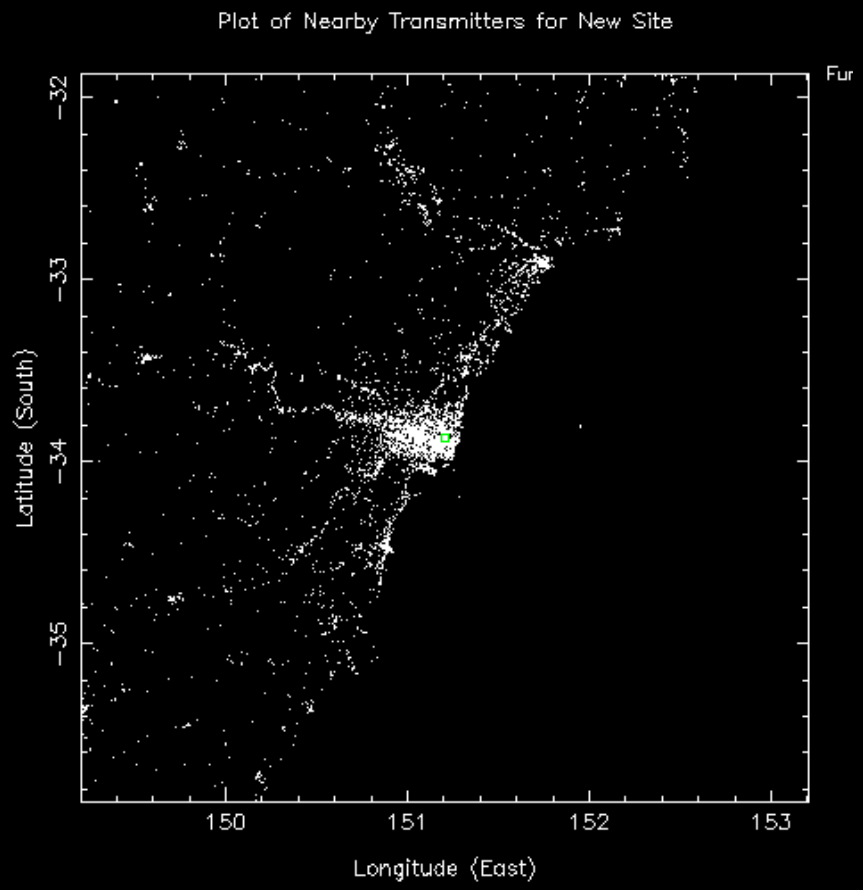
NFM Specified BW:
15kHz/-6dB
NFM Measured BW:
17kHz/-6dB

WFM Specified BW:
230kHz/-6dB
WFM Measured BW:
313kHz/-6dB

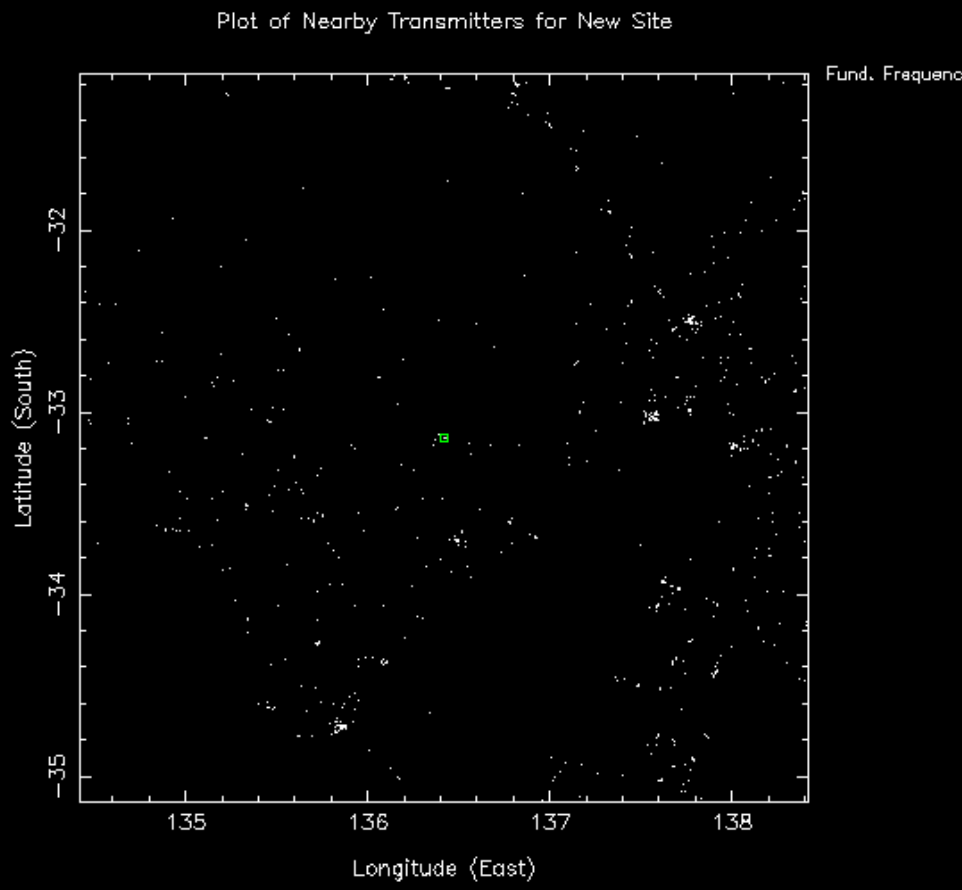
Uncalibrated SEARFE Results from Kimba Area School and Abbotsleigh High School



RF Transmitters within ~200km of Sydney and Kimba

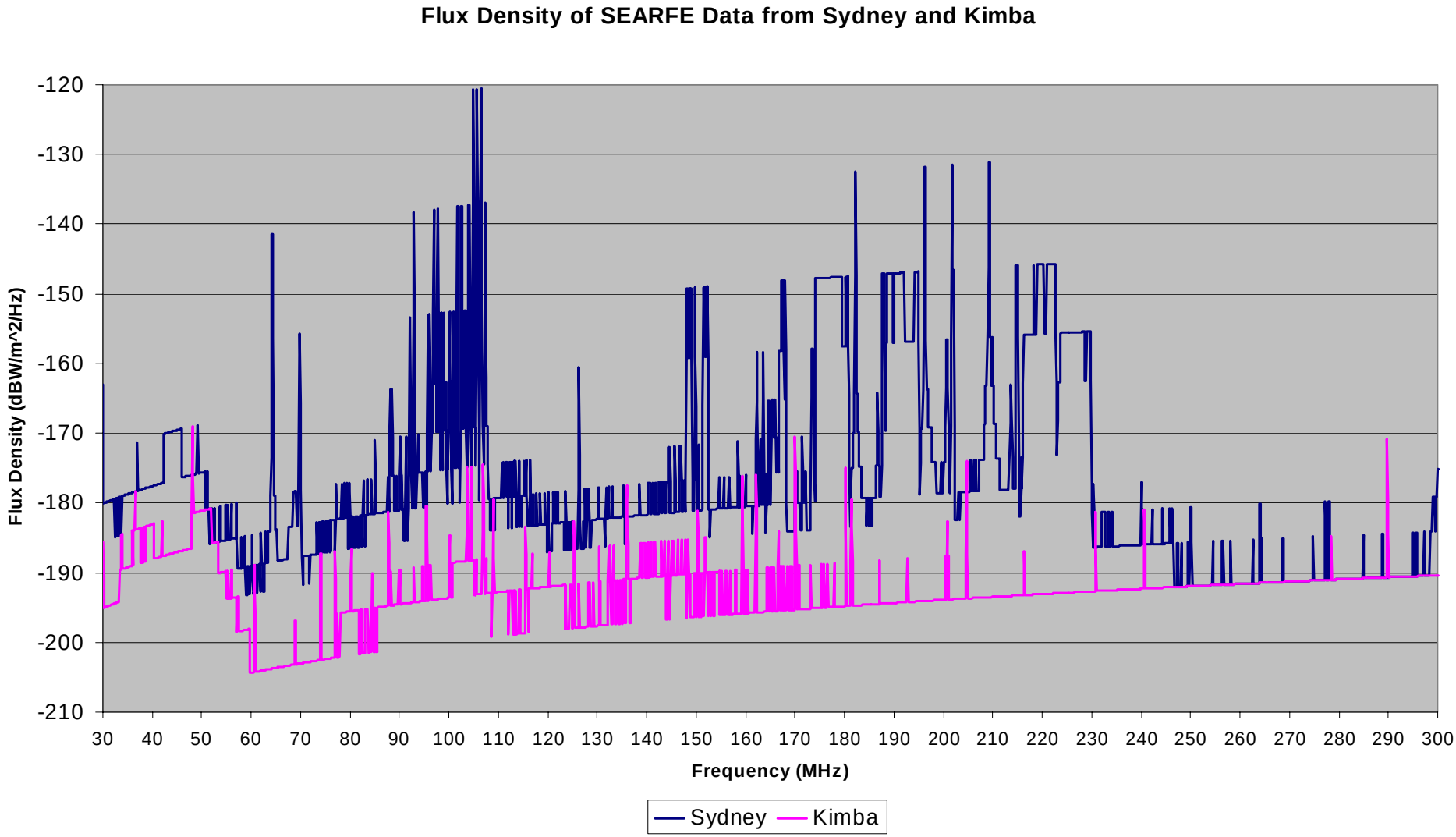


Sydney (NSW)

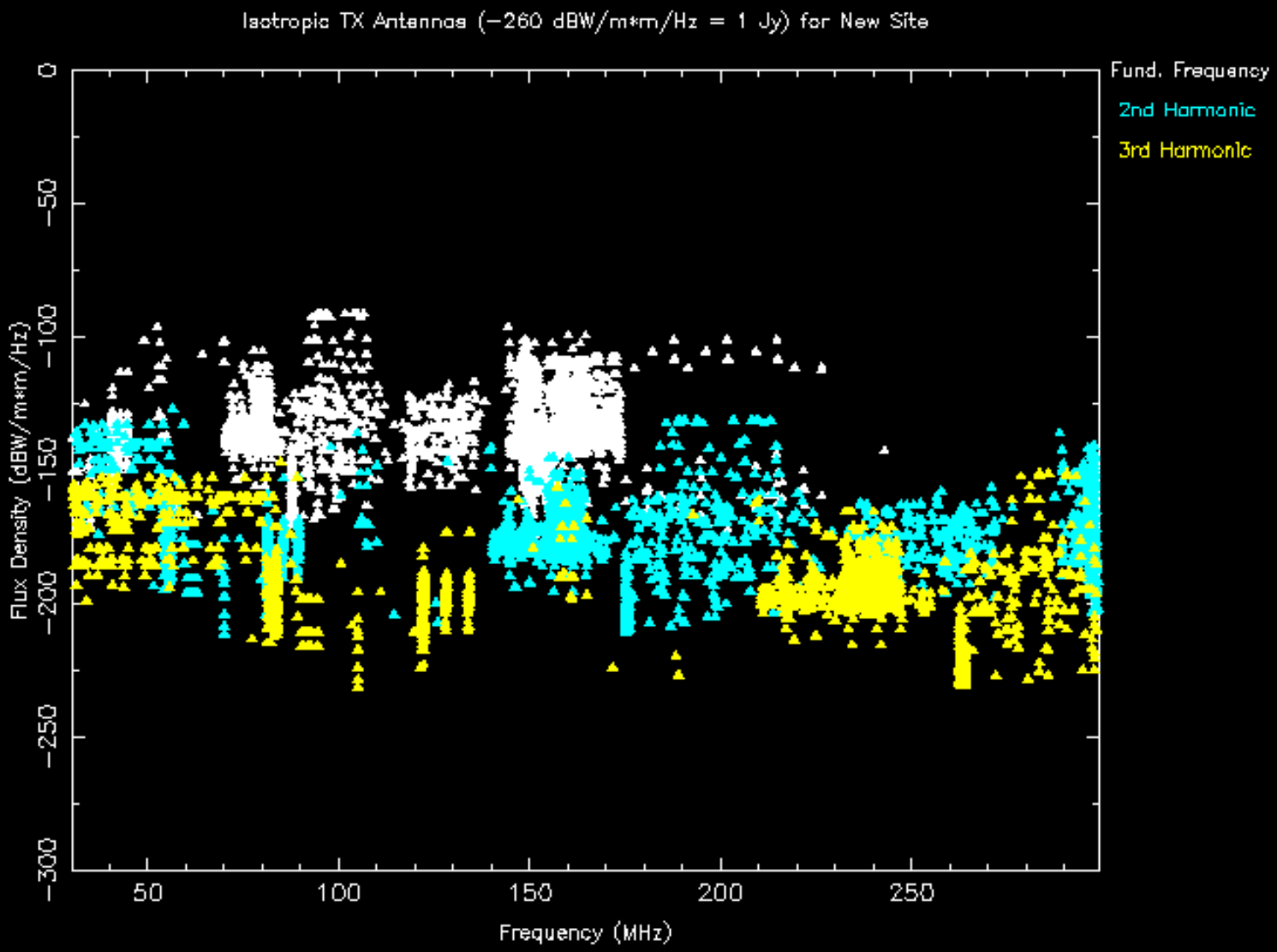


Kimba (SA)

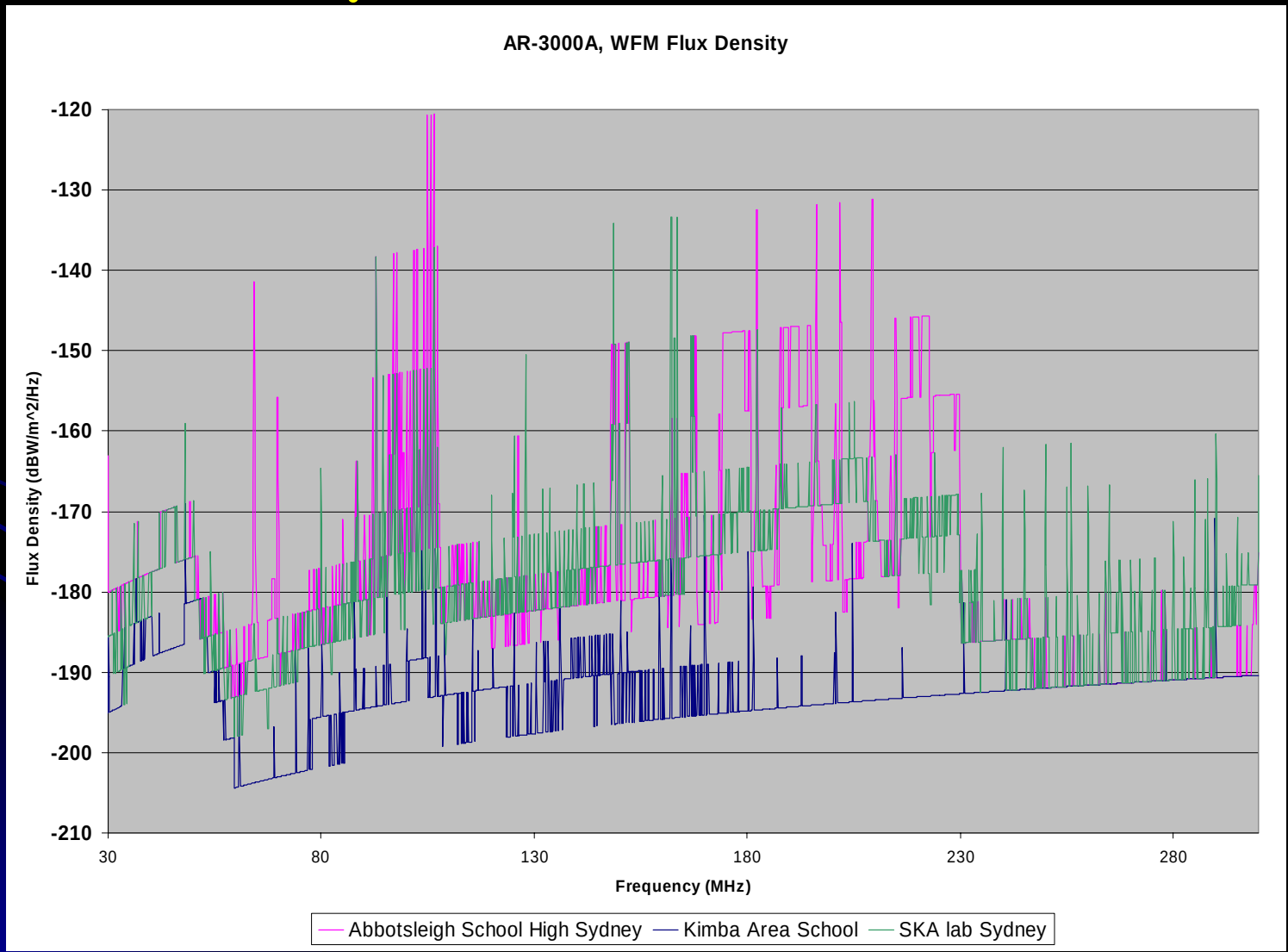
Flux Density of SEARFE Results for Sydney and Kimba



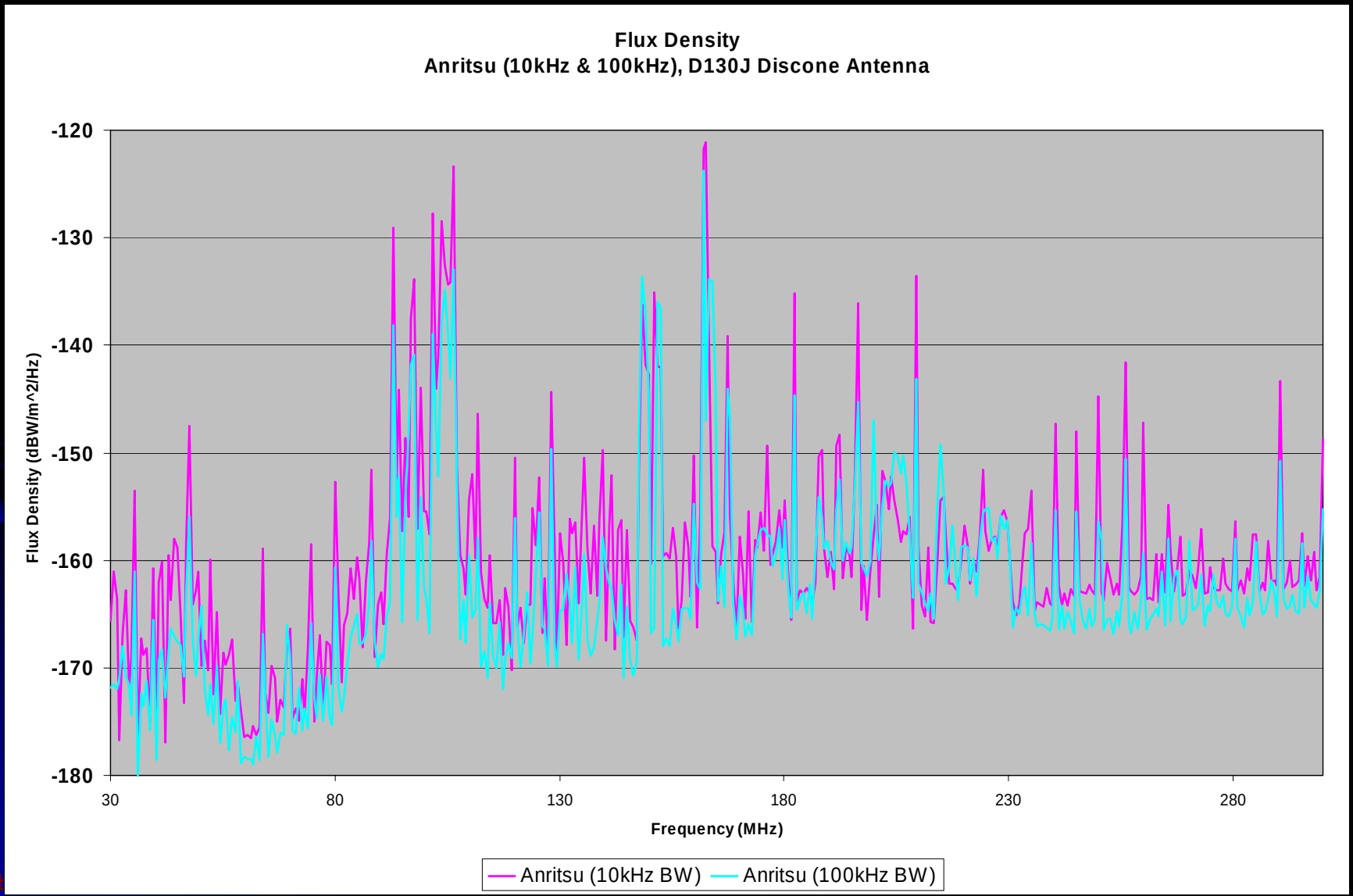
INTER Predicted Flux Density Sydney 30-300 MHz



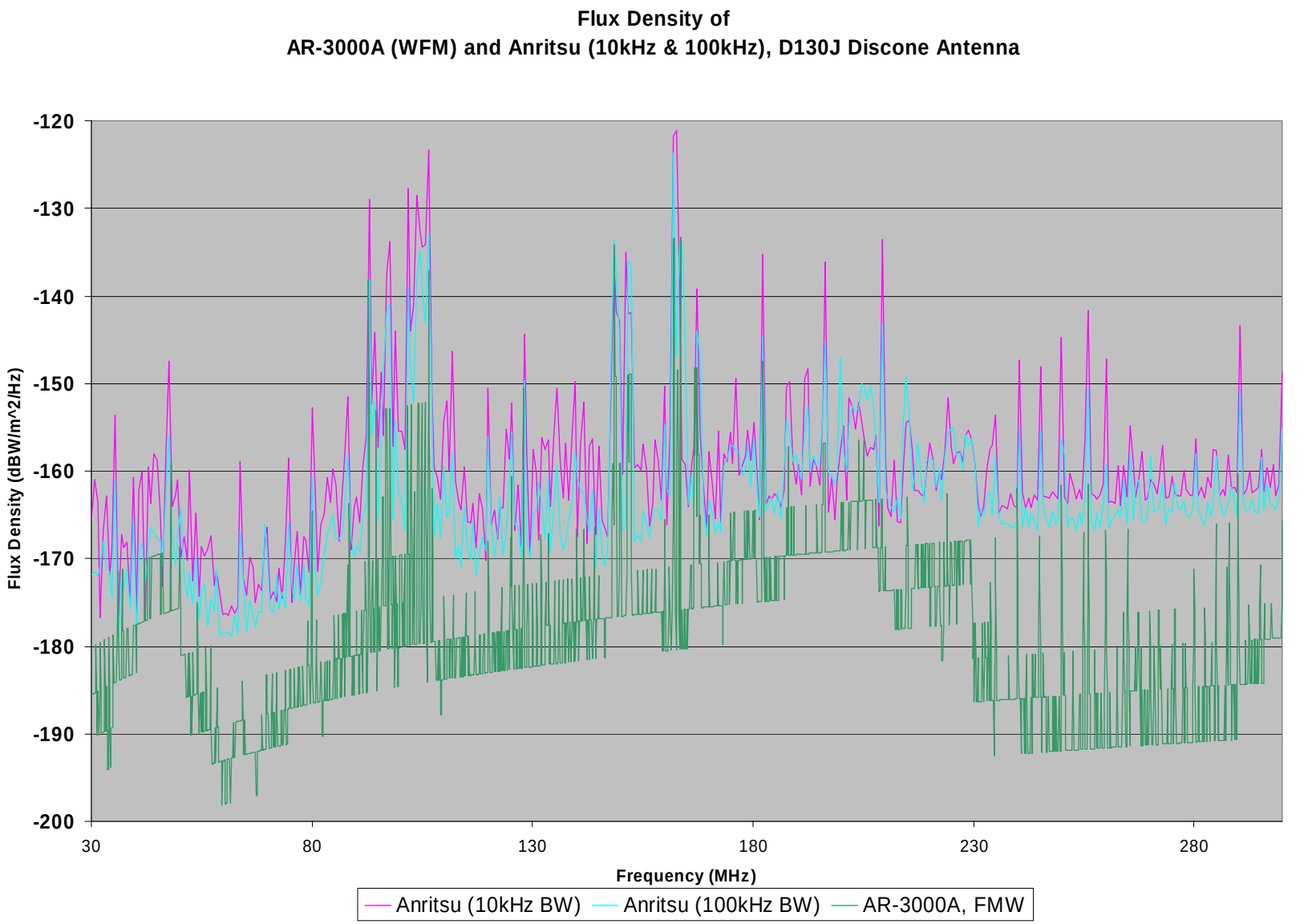
Calibrated SEARFE Results from Kimba Area School and Abbotsleigh High School plus SKA lab (Marsfield)



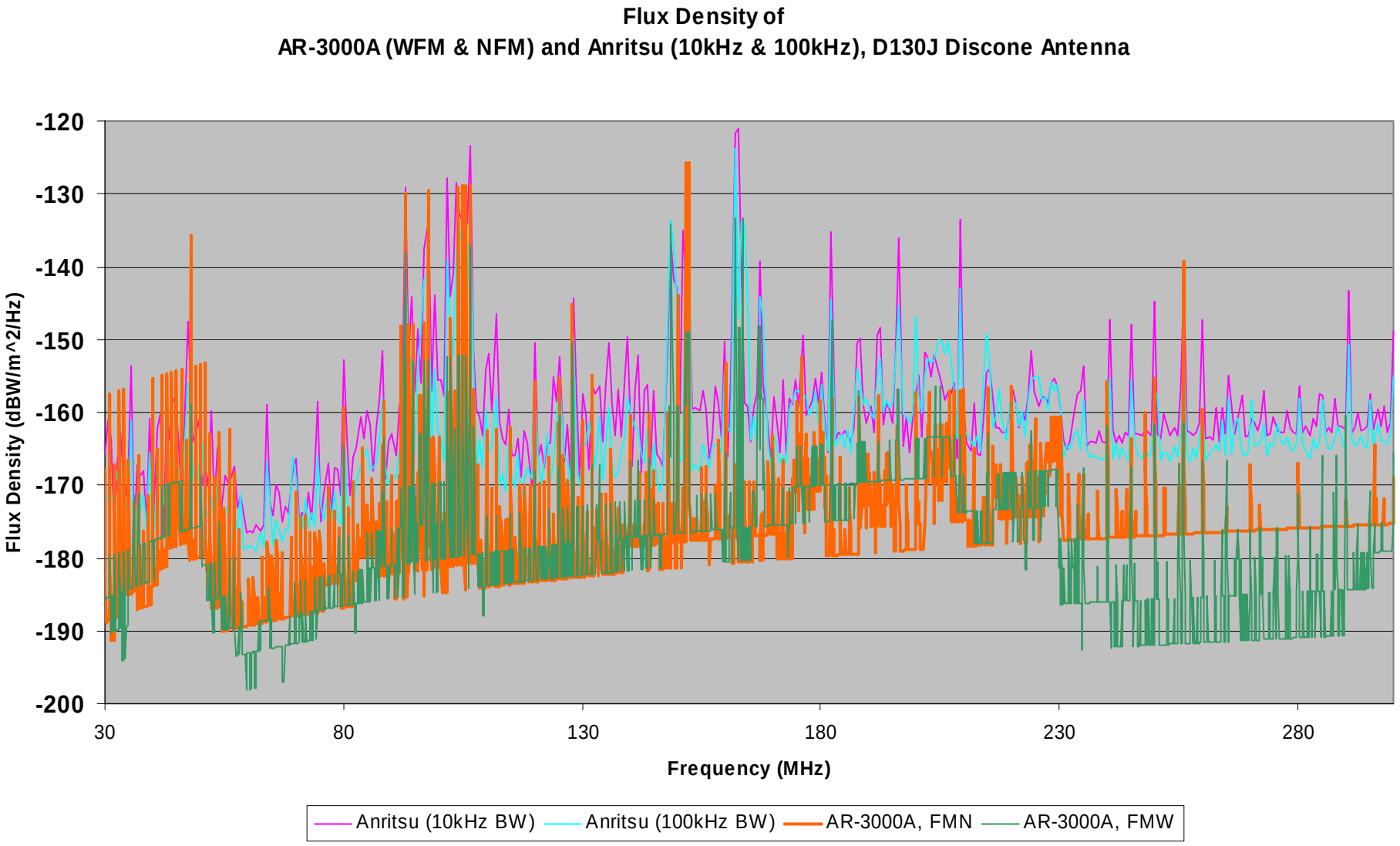
Flux Density of Anritsu Spectrum Analyser scan 30MHz-300MHz for 10kHz & 100kHz BW



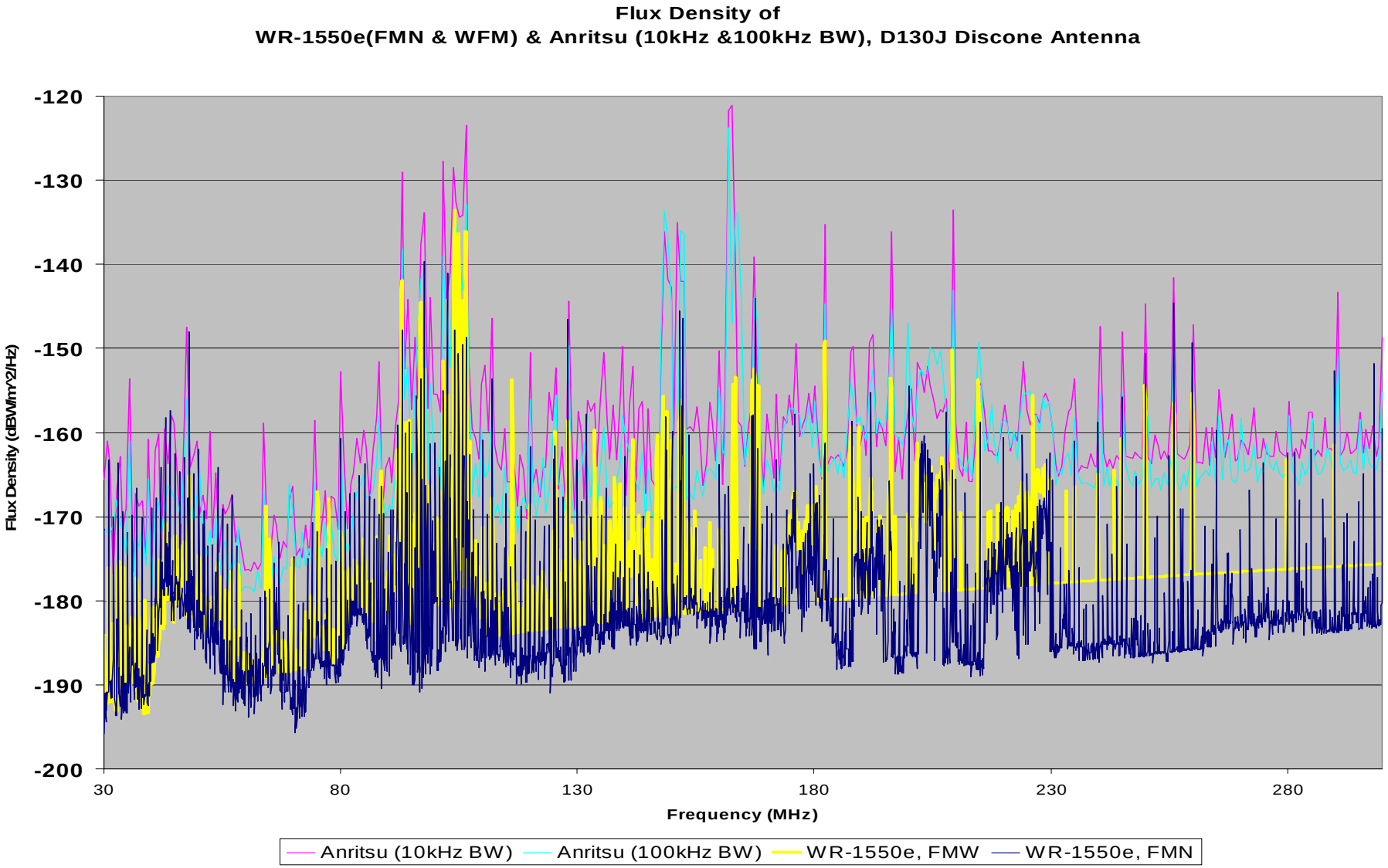
Flux Density of AR-3000A in WFM & Anritsu (10KHz & 100kHz BW) for 30MHz-300MHz



Comparison of Flux Density of AR-3000A in WFM & NFM & Anritsu (10KHz & 100kHz BW) for 30MHz-300MHz



Comparison of Flux Density of WR-1550e in WFM & NFM & Anritsu (10KHz & 100kHz BW) for 30MHz-300MHz




END
of
Presentation