

# Cheap Chinese Radios

The Good, the Bad and the Ugly

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**Flathead Valley Amateur Radio Club**

# Introduction

- Ever wonder why some of your HTs get into a repeater from a certain location, but others cannot?
- Your HT's antenna and TX power on the fundamental frequency are more important than whether it's a 4 W radio or an 8 W radio
  - An antenna with a high SWR will reflect rather than radiate a portion of TX RF
  - TX power in harmonics is wasted power and may interfere with Land Mobile, public safety and military users
    - Some Chinese radios tested radiate as much as two-thirds of their transmitted power in harmonics
  - None of the major Chinese brands submits Part 90 (Private Land Mobile Radio Services), Part 95 (Personal Radio Services), nor Part 97 "spurious emissions" tests
    - As long as the device can only operate on frequencies assigned to the Amateur Radio Service, FCC equipment authorization is not required
  - All of the radios covered in this presentation submitted Part 15 tests which are required of unlicensed low-power intentional transmitters and electronic and digital devices
    - This gives them an FCC ID for their radio and they hope you'll assume that means Part 97 requirements have been met

# Introduction (cont.)

- Transmit power was tested using an SW-33PLUS SWR meter from Surecom
  - This gets the stock antenna as close as possible to the radio
  - 146 MHz was used for all tests, as spurious emissions are usually much worse on VHF
  - Measured SWR with stock antenna may be somewhat different from that with the antenna mounted right on the HT
    - Precise measurement involves using a precision field strength meter to measure radiated power from a precision reference antenna, then measuring it again with the antenna under test, all in an RF-shielded chamber (none of which I have)
- Spurious emissions were measured using a Rigol DSA815-TG tracking spectrum analyzer
  - HTs were connected through a 50 dB attenuator
  - Per FCC regulation **47 CFR § 97.307 (e)**, transmitters operating between 30-225 MHz, with a mean power less than or equal to 25W, must keep spurious emissions at least 40 dB below the fundamental and they must not exceed 25 uW (-16 dBm)



# Baofeng UV-5R

- First dual band (VHF/UHF) Chinese HT successfully distributed worldwide
  - Introduced in 2012
  - No FCC Part 90, Part 95 (e.g., FRS & GMRS), nor Part 97 certification
    - Not legal for use outside of the amateur radio bands
  - Radio sports an FCC ID, but it's only registered under Part 15
- Many iterations with no reliable version tracking
  - Many knockoffs with same specs, menu and functions and often using the same FCC ID
- Mine came with a fairly decent stock antenna
  - SWR: 1.01:1 on VHF call frequency; 2.5 on UHF Call frequency
- CHIRP programmable
- Claims 5 W on VHF; 4 W on UHF
  - Exceeds spec into a dummy load
  - Meets spec with stock antenna
- Typically priced around \$20



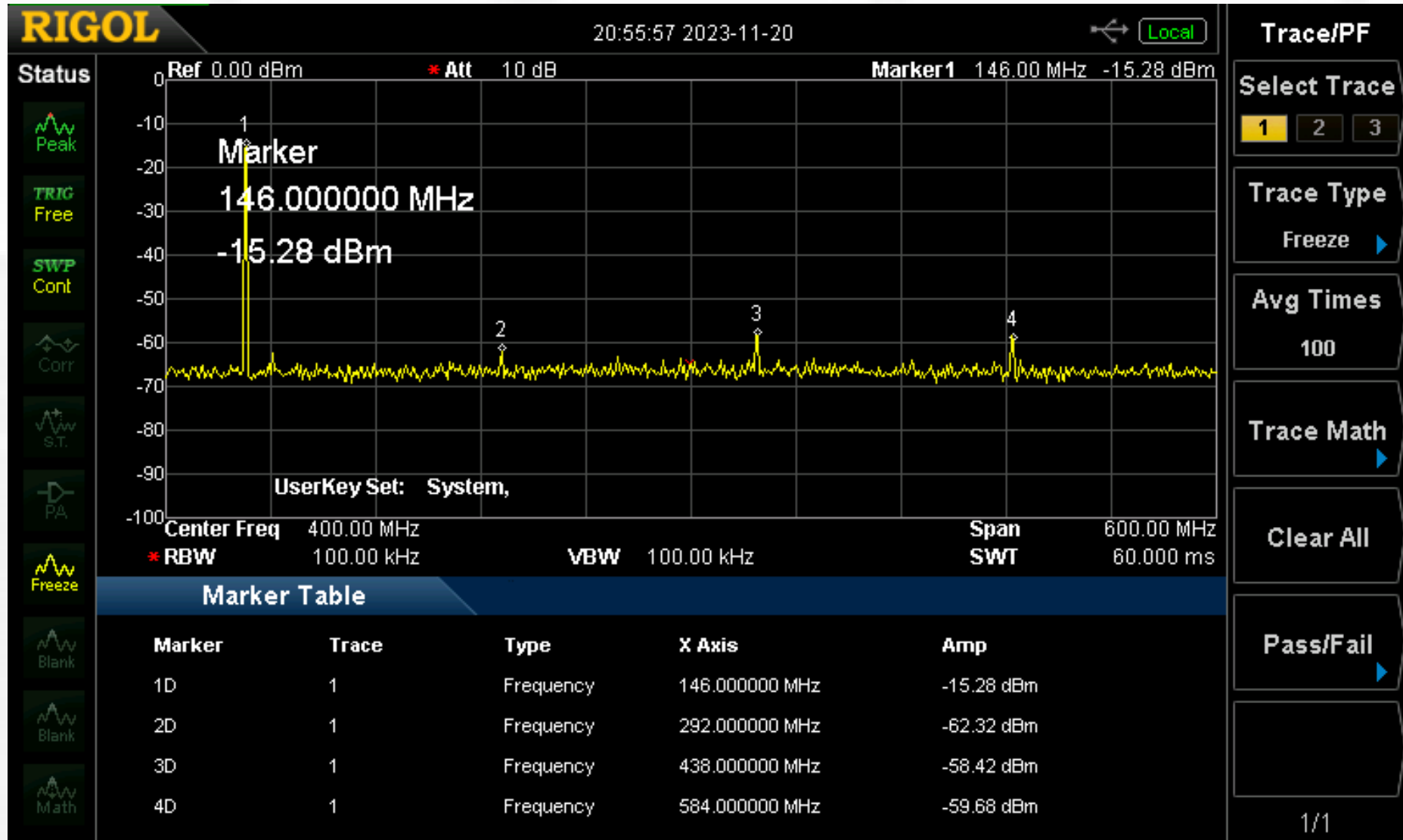
# Baofeng UV-5R Spurious Emissions

- Harmonic suppression fails to meet FCC requirements for harmonics not to exceed -16 dBm in power
  - Spurious emissions are unacceptable in many countries, with test results varying substantially between units tested
    - Could there be a QA problem on the manufacturing line?
    - Could there be differences between the different “UV-5R” offerings?
- Has caught the attention of many telecommunications regulators
  - Banned from sale and use in Switzerland, Germany, Poland and South Africa
  - Other countries are considering banning it as well
  - When traveling abroad, you might find you can't take your UV-5R with you
  - Will the U.S. come down on these radios?





# UV-5R Spurious Emissions

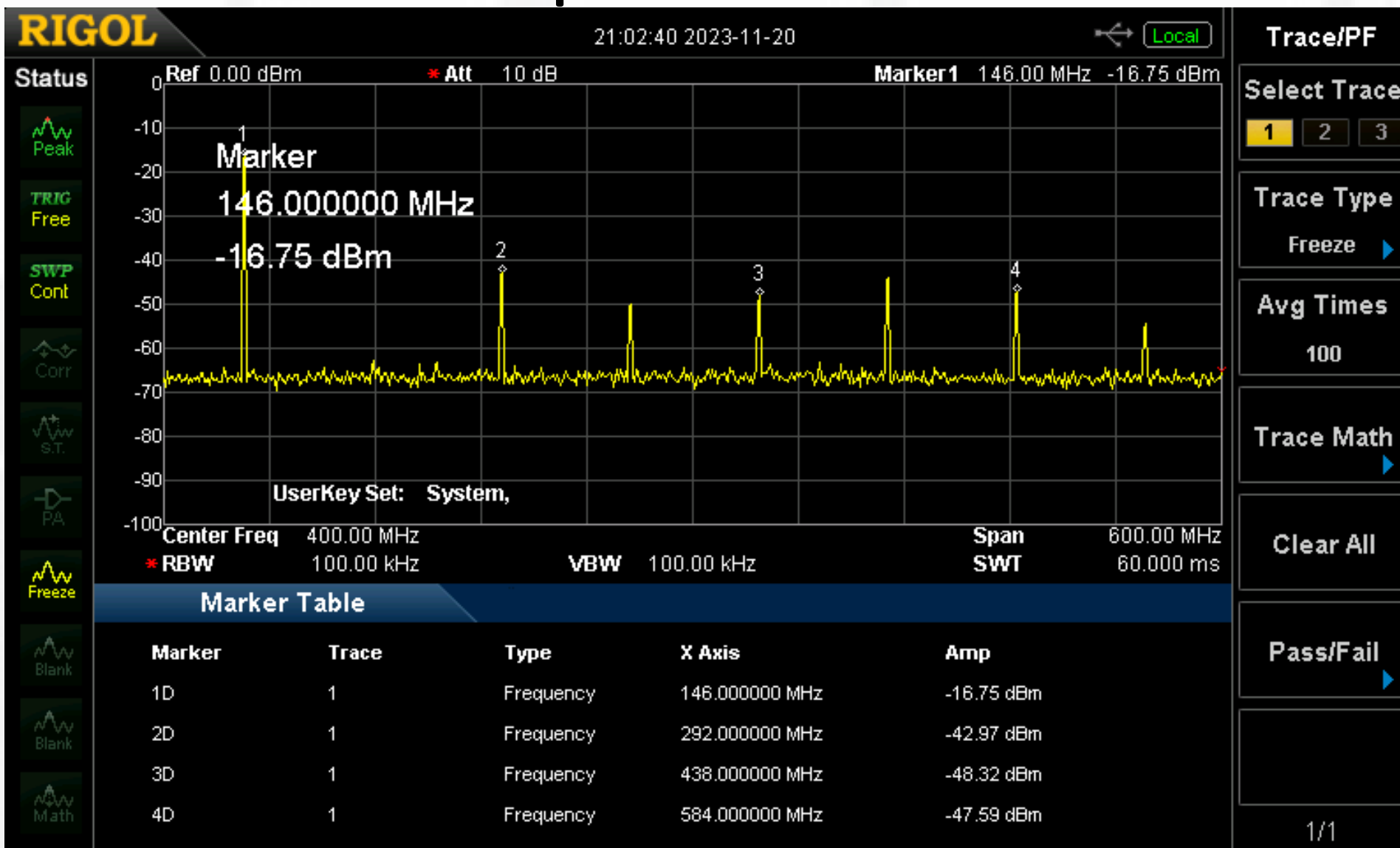


# BTECH (Baofeng Tech) UV-5X3 Triband HT

- Supports 2m, 1.25m and 70cm
- Claims to be 5 W on all three bands
  - Exceeds spec on all three bands into a dummy load
  - Essentially meets specs with supplied rubber dummies
  - First triband Chinese HT I've seen which puts out more than a couple of hundred mW on 1.25m
- Comes with 2 antennas
  - 2m/70cm rubber ducky
  - 1.25m rubber ducky
- CHIRP programmable
- Really nasty spurious emissions
- \$65 from BTECH (BaofengTech.com) in the US



# UV-5X3 Spurious Emissions:



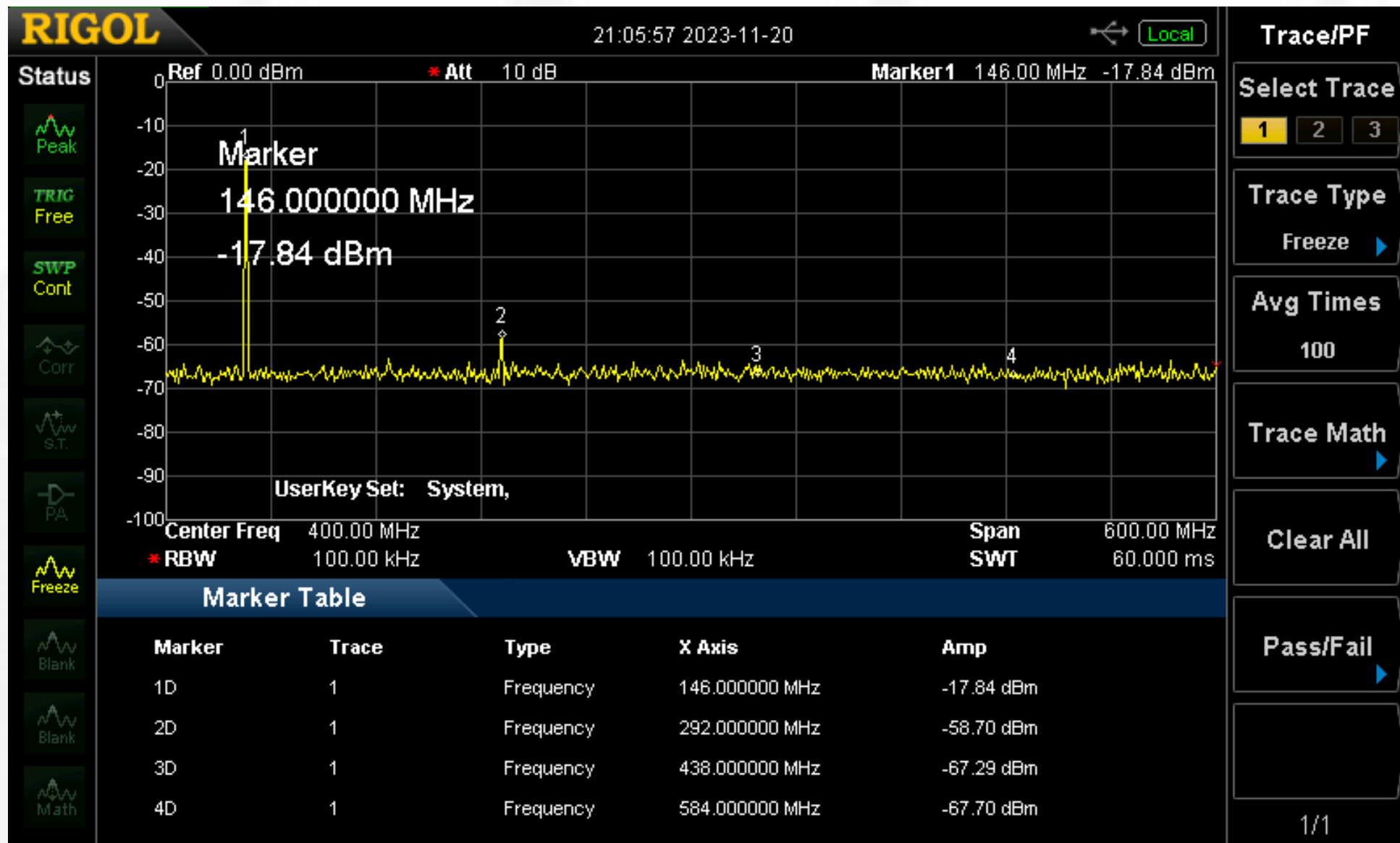


# Radioddity UV-5RX3

- Functionally similar to the BTECH UV-5X3
  - Both made for them by Baofeng
- Also comes with 2 rubber duckies
- Claimed TX power is 5 W on all bands
  - Exceeds spec on 1.25m and 70cm into a dummy load
  - Essentially 4 W on 2m into a dummy load
  - Exceeds spec on 1.25m and 70cm with stock antenna
  - Slightly under spec on 2m with stock antenna
- **NOTE: CHIRP claims to support this radio, but using it will lock out the 1.25m band, apparently permanently**
  - Use Radioddity's free CPS software for now
- Currently offered as a bundle for \$35
  - 3800 mAh second battery
  - Programming cable
- Inexpensive way to get into the 220 MHz band
  - NE7AL has a 1.25m repeater in Bigfork (224.980(-), 123 Hz tone)
  - While not meeting Part 97 on 2m, it does on 1.25m and 70cm



# UV-5RX3 Spurious Emissions:

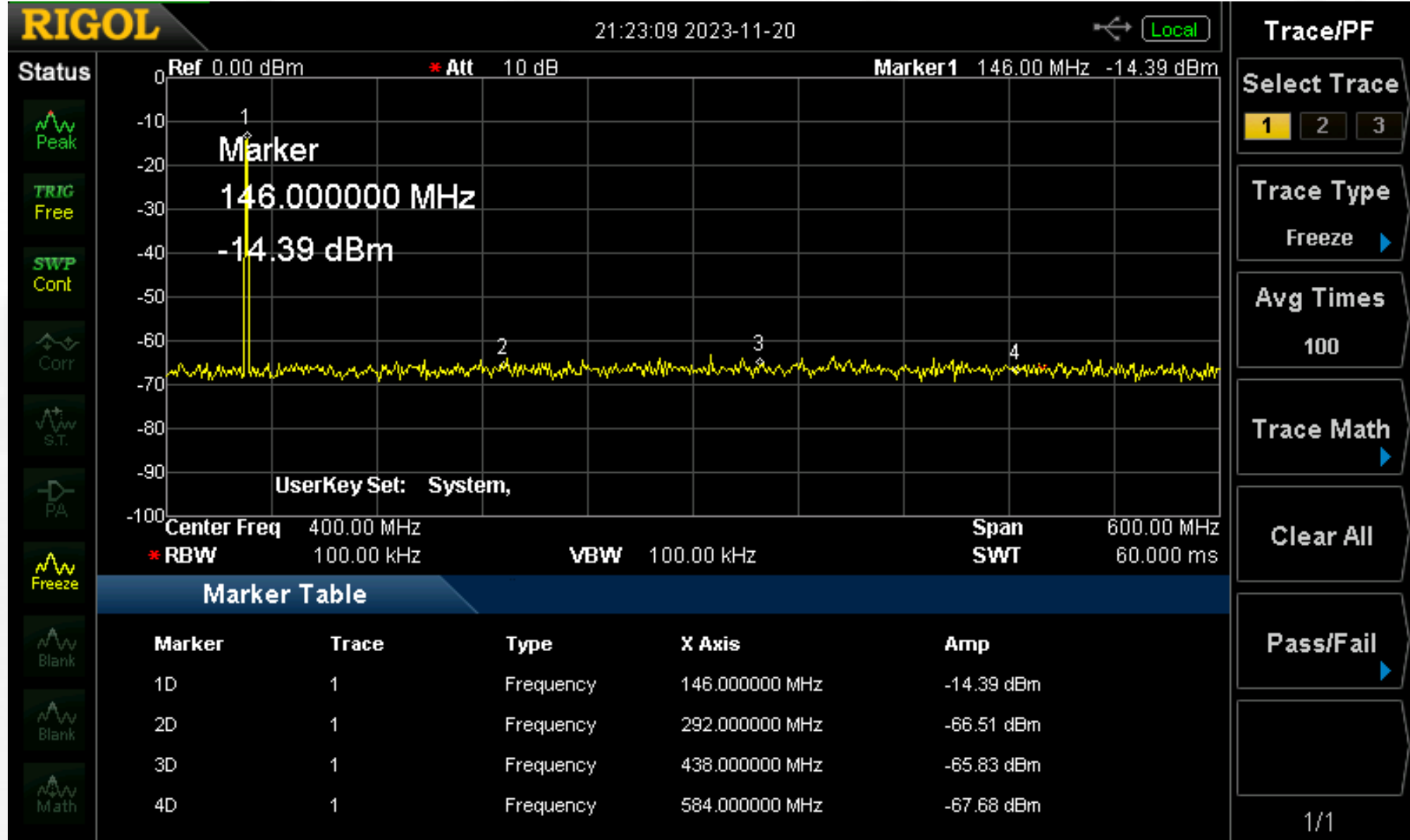


# Radioddity GA-510

- Radio has a nice professional feel
- High contrast display is easy to read in sunlight
- Claims to be a 10 W dual-band radio
  - TX power is 7.4 W on 2m, and 6.6 W on 70cm into dummy load
  - TX power is 5.42 W on 2m, and 8.02 W on 70cm with stock antenna
- Radio tested met Part 97 spurious emission requirements
- Initial production radios were CHIRP programmable
  - New production radios with upgraded processor require Radioddity's free CPS software
    - Radioddity is reportedly working on a firmware update for CHIRP compatibility
- Charger annoyingly flashes red, then green and repeats forever if there's no battery or radio in the charger
- Currently available as a bundle with:
  - Second battery
  - Programming cable
  - Shoulder speaker-mic



# GA-510 Spurious Emissions:

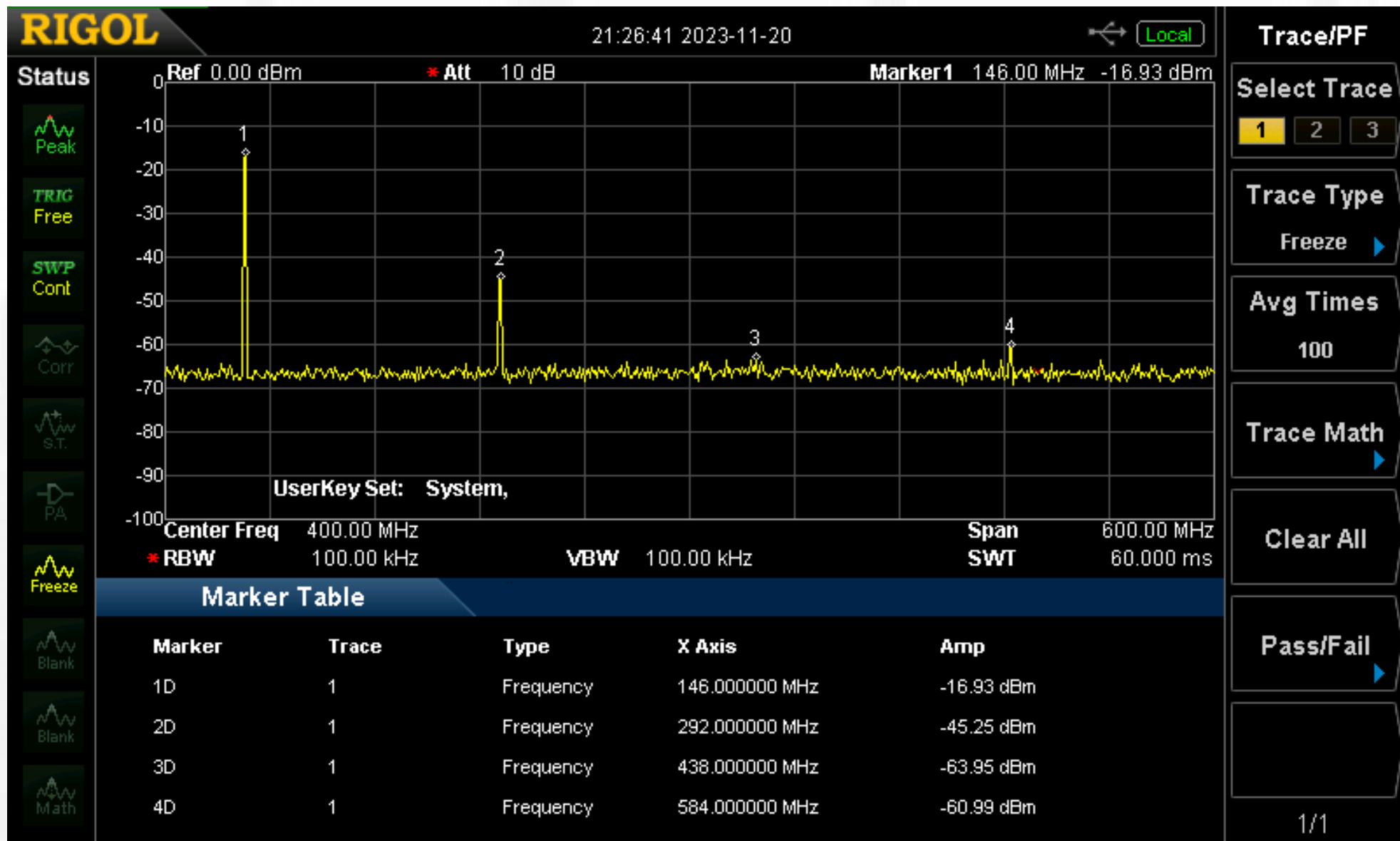


# Radioddy GC-5

- Dual band with NOAA Weather RX
- 1.8" Color TFT display
- Wireless frequency copy from one GC-5 to another GC-5
- “Water resistant”, but no IPxx rating provided
- Solid, professional feel
- Spec'd as 5 W radio
  - Essentially meets spec into a dummy load
  - Meets spec on UHF, exceeds spec on VHF using stock antenna
- Manufacturer's test report submitted to FCC on 11-13-23
  - Tested to what Parts of Title 47?
  - FCC ID doesn't yet show up in the FCC's database
  - Radio tested failed Part 97
- Currently offered at \$25



# Radioddity GC-5 Spurious Emissions:



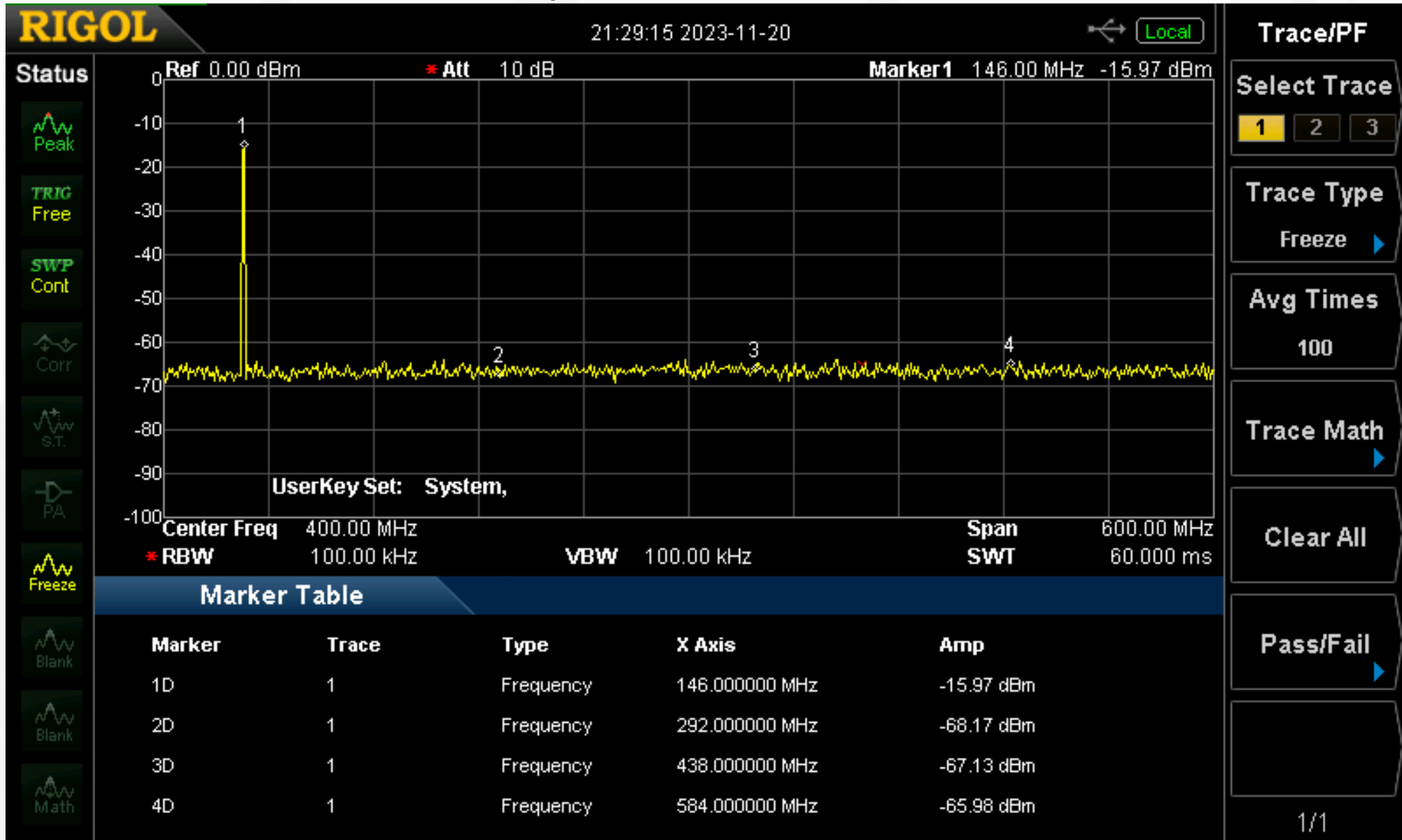


# Baofeng GT-5R

- Advertised as “FCC Compliant”
  - Claims to meet Part 97 spurious emission limits
  - Claims to be limited to the amateur radio 2m and 7cm bands
  - Its claims are justified
- Compatible with other UV-5R accessories
- Advertised as a 4 W dual band radio
  - Exceeds specs into dummy load and with stock antenna
    - Actual TX power is closer to 5W
- Currently offered at \$27



# GT-5R Spurious Emissions:

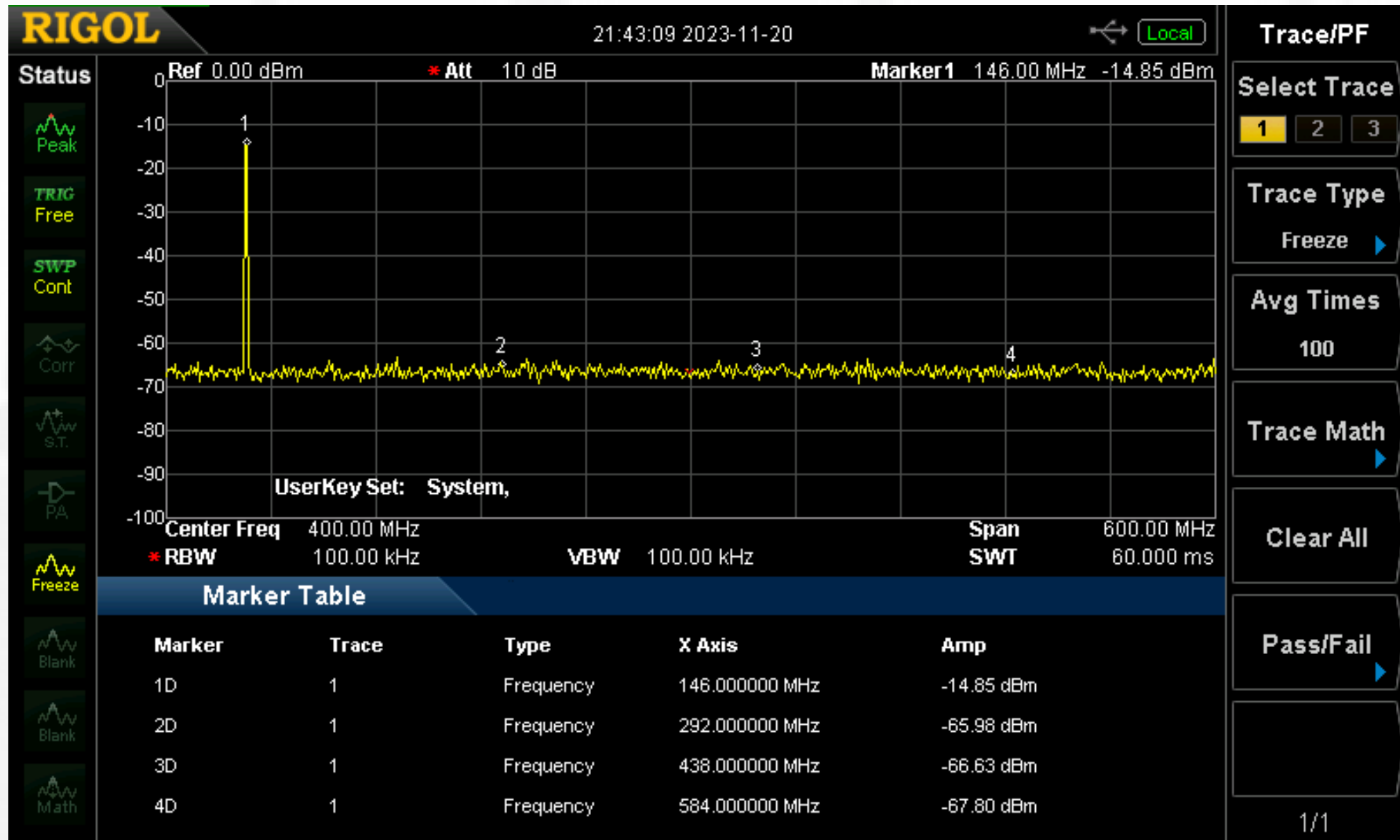


# Baofeng UV-9R Pro

- Claims to be waterproof to IP67 standard
  - Submersible to 1m for 30 minutes
    - Others have verified this
  - Uses Motorola type accessory port for water tightness
    - Won't be able to share other Baofeng accessories which use the "K" type connector
- Battery retention clasp seems flimsy
- Rechargeable in its base or by Type C USB connection directly to the battery (port on its back side)
  - Proper placement in base charger can be a bit tricky
- CHIRP Programmable
- Claims to be an 8 W dual band HT
  - Nearly 7 W into a dummy load
  - VHF: 6.77 W ; UHF: 5.45 W into supplied rubber duckie
- Meets Part 97 spurious emission requirements



# UV-9R Pro Spurious Emissions:

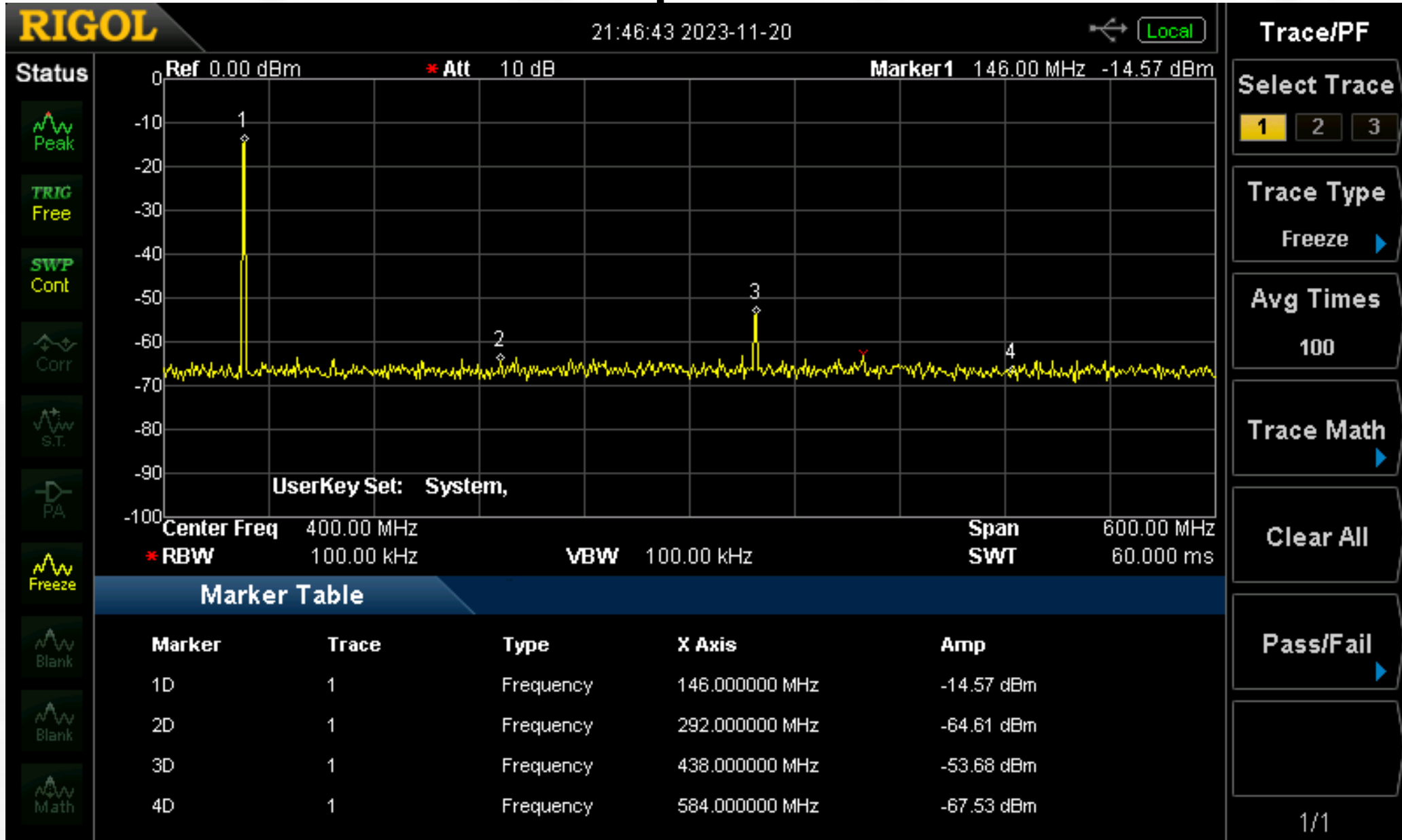


# Baofeng UV-13 Pro V2

- Seems to be a Baofeng China version sold only on ebay
- Makes no claim to having an FCC ID
  - Does not meet Part 97
- Currently charges by USB Type C port on bottom of battery
  - Contacts on back of battery suggest a base charger may be offered later
- Claims to be a 10 W dual band HT
  - Measured 7.11 W on VHF and 6.8 W on UHF into a dummy load
  - 5.09 W VHF and 6.44 W UHF using stock antenna
- \$40 for one radio or \$60 for two



# UV-13 Pro V2 Spurious Emissions:



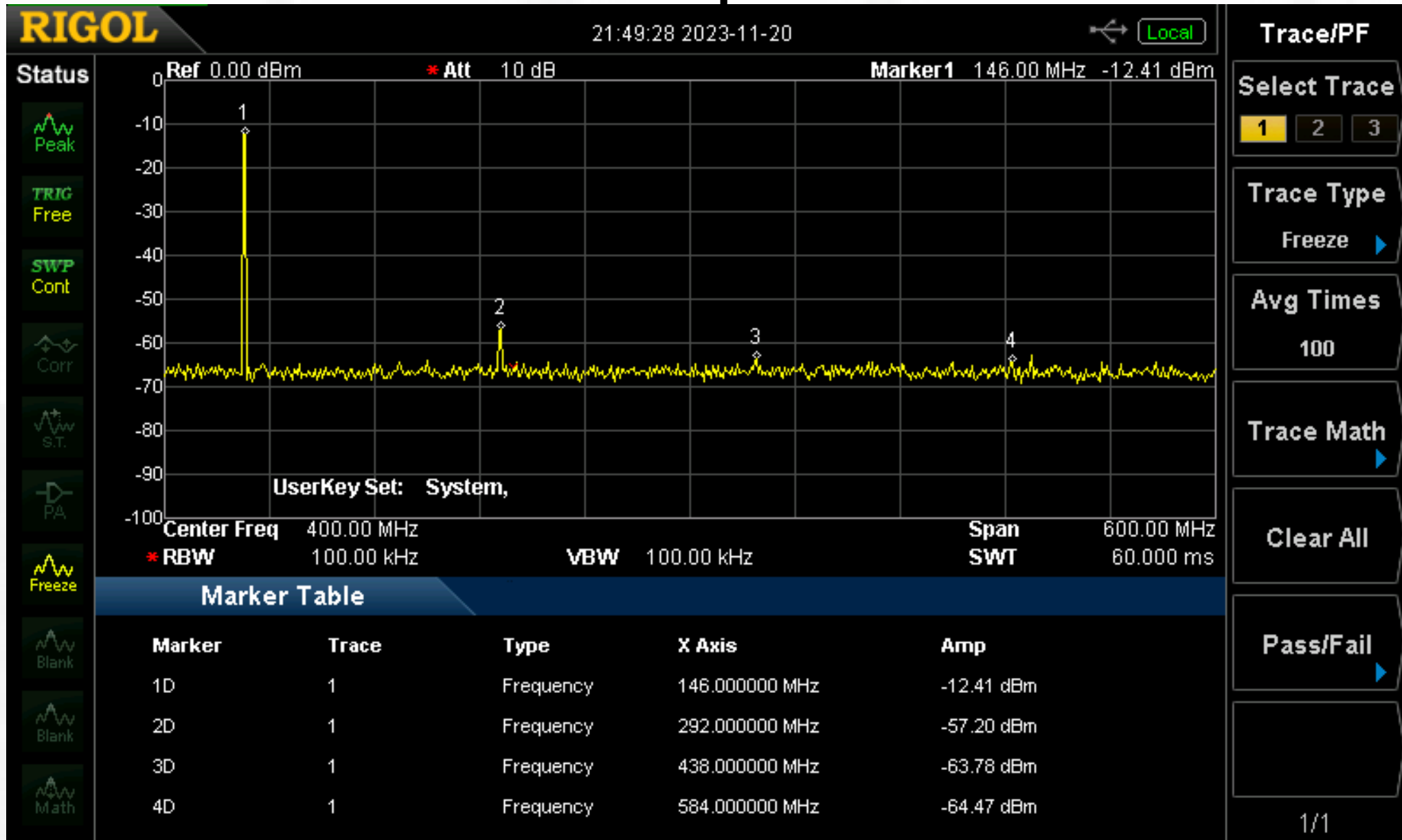


# TIDRADIO TD-H8 2<sup>nd</sup> Gen

- Base charging and USB Type C charging
  - Type C port and charge indicator LED are on the bottom of the radio
- NOAA Weather RX
- Radio can be programmed via Bluetooth and Odmaster smartphone app
  - Download local repeater directory into radio while traveling
- CHIRP programmable
  - Standard Kenwood “K” type port
- Large color display with lots of information
- Claims to be a “real” 10 W dual band radio
  - Exceeds spec into a dummy load
  - Reasonably close to spec with stock antenna
  - Mid-power setting is approximately 5 W
  - Low-power setting is approximately 2.5 W
- Failed FCC spurious emissions requirement limiting harmonic power to no more than -16 dBm
- Can be “unlocked” for GMRS
- Amazon price: \$60



# TIDRADIO TD-H8 Spurious Emissions:



# W7YP's Top Picks

- Dual band HTs
  - \$35 or less AND Part 97 compliant:
    - Baofeng GT-5R at \$25-27
    - Baofeng UV-9R Pro at \$30
      - “Waterproof” – IP67 rated
      - Roughly 7 W TX power on “High”
      - CON: Requires its own programming cable at \$13
  - \$70 or less: Radioddity GA-510
    - Clean RF at 7-8 W output
    - Very readable display, even in sunlight
- Tri-band HT: Radioddity Baofeng UV-5RX3 for \$35
  - Very inexpensive way to get into 1.25m
    - Part 97 compliant on 1.25m and 70cm
  - 6 W output on 1.25m, unlike so many Chinese HTs claiming 1.25m support
    - Most others tested only put out 100-200 mW or thereabouts
  - Only failed the peak harmonic power limit of -16 dBm by a few dB on 2m
    - Very unlikely to actually cause interference, but technically not legal on 2m

# HT Comparison

Manufacturer	Model	Price	RF Range	CHIRP	FCC ID	Legit ID	Part 97 OK**	TX 2m	TX RD	SWR RD	TX 1.25m	TX RD	SWR RD	TX 70cm	TX RD	SWR RD
Baofeng	UV-5R	19	136-174/400-520 MHz	YES	ZP5BF-5R	YES <sup>10</sup>	NO	6.35 W <sup>4</sup>	5.81 W	1.01				5.14 W <sup>4</sup>	3.68 W	2.50
BTECH (Baofeng Tech)	UV-5X3	65	144-148/222-225/420-450 MHz	YES	2AGND-5X3	YES	NO	5.22 W	4.85 W	1.8	6.95 W	6.02 W	2.63	5.5 W	4.8 W	2.98
Radioddity	UV-5RX3	35 <sup>1</sup>	144-148/222-225/420-450 MHz	NO <sup>11</sup>	2AJGM-UV5R	YES <sup>5</sup>	NO <sup>12</sup>	3.9 W	4.3 W	1.01	6.1 W	5.42 W	2.63	5.4 W	4.57 W	3.30
Radioddity	GA-510	70 <sup>6</sup>	136-174/400-480 MHz	NO <sup>2</sup>	2AN62-GA510	YES <sup>8</sup>	YES	7.4 W	6.8 W	1.01				6.6 W	8.02 W	3.90
Radioddity	GC-5	25	144-148/420-450 MHz	NO	2AN62-GC5	NO <sup>9</sup>	NO	4.65 W	7.04 W	2.41				4.89 W	4.94 W	3.21
Baofeng	GT-5R	27	144-148/420-450 MHz	YES	2AJGM-UV5R	YES <sup>5</sup>	YES	5.45 W	4.71 W	3.13				4.96 W	4.39 W	3.95
Baofeng	UV-9R Pro	30	136-174/400-520 MHz	YES	2AJGM-UV9RPRO <sup>7</sup>	YES	YES	6.95 W	6.77 W	1.72				6.67 W	5.45 W	3.38
Baofeng	UV-13 Pro V2	40/ 60 pr	136-174/400-520 MHz	YES	None Claimed	N/A	NO	7.11 W	5.09 W	2.09				6.8 W	6.44 W	3.94
TIDRADIO	TD-H8 <sup>3</sup>	60	144-148/420-450 MHz	YES	2AWL3-TDH8	YES	NO <sup>12</sup>	11.3 W	8.79 W	2.19				10.1 W	8.3 W	4.56

**NOTE: All "legit" FCC IDs are specific to Part 15 test reports, NOT Part 97; None of these radios are Part 97 certified**

**\*\* This only means that my testing showed that the radio under test met Part 97 Spurious Emission requirements**

\*1 Bundle with 3800 mAh battery and programming cable currently available for \$35

\*2 Worked until recent production

\*3 2nd Generation

\*4 VFO Mode changes 146.520 to 146.500; 433.520 to 433.500

\*5 FCC ID also applies to UV-5X3, UV-5RIII and GT-5R

\*6 Bundle with programming cable, two batteries and shoulder speaker-mic

\*7 Also covers UV-9R Plus, WP-9R, AR-9

\*8 Transferred FCC ID report from 2AJGMBF-H6 to this new FCC ID

\*9 FCC Report was submitted to the FCC on November 13, 2023

\*10 Met Part 15 and Part 90 Test Requirements

\*11 CHIRP will appear to work and program the radio; however, it will permanently lock out the 1.25m band

\*12 Came close to passing, failing the -16 dBm maximum harmonic power by single digits

TX [band] is TX power measured into a dummy load for that band

TX RD is TX power measured into stock antenna on the same band

SWR RD is SWR with stock antenna per the same band

“RD” is for “Rubber Ducky”

# References

- Baofeng UV-5R
  - [Amazon.com: Baofeng UV-5R Two Way Radio Dual Band 144-148/420-450Mhz Walkie Talkie 1800mAh Li-ion Battery\(Black\) : Electronics](#)
- BTECH UV-5X3
  - [BTECH UV-5X3 \(baofengtech.com\)](#)
- Radioddity UV-5RX3
  - [Baofeng x Radioddity UV-5RX3 Tri-band Walkie Talkie 136-173.975MHz \(VHF\), 200-259.975MHz \(1.25M\), 400-519.975MHz \(UHF\) Ham Amateur Two Way Radio](#)
- Radioddity GA-510
  - [Radioddity GA-510 | 10W | Dual Band | Tri-power | 2 Batteries](#)
- Radioddity GC-5
  - [Radioddity GC-5 | Dual Band | 5W | 999 CH | Remote Frequency Copy | Co](#)

# References (cont.)

- Baofeng GT-5R
  - [Amazon.com: BAOFENG GT-5R Dual Band Two Way Radio 144-148/420-450MHz, FCC Compliant Version of Baofeng UV-5R, Ham Radio Handheld for Adults, Supports Chirp : Electronics](#)
- Baofeng UV-9R Pro
  - [Amazon.com: BAOFENG Ham Radio Handheld Walkie Talkie Rechargeable \(Upgraded Version of UV-5R\) UV-9R PRO 8W Waterproof IP67 Two-Way Radio Dual Band Transceiver for Hiking Hunting Camping : Electronics](#)
- Baofeng UV-13 Pro V2
  - [2pcs Baofeng UV-13 PRO V2 Powerful Dual Band Ham Two Way Radio Portable Handheld | eBay](#)
- TIDRADIO TD-H8, 2<sup>nd</sup> Gen
  - [Amazon.com: 2nd Gen TIDRADIO TD-H8 Ham Radio 10Watt 2500mAh Battery Capacity Solid Performance Handheld Two-Way Radio Wireless Programming Module with Repeater List : Electronics](#)



A row of five Motorola HT radios is shown in the background, slightly out of focus. Each radio has a long antenna pointing upwards. The central two radios have small LCD screens displaying numbers. The text 'Q & A' and 'HT Testing' is overlaid in the center of the image.

# Q & A

## HT Testing