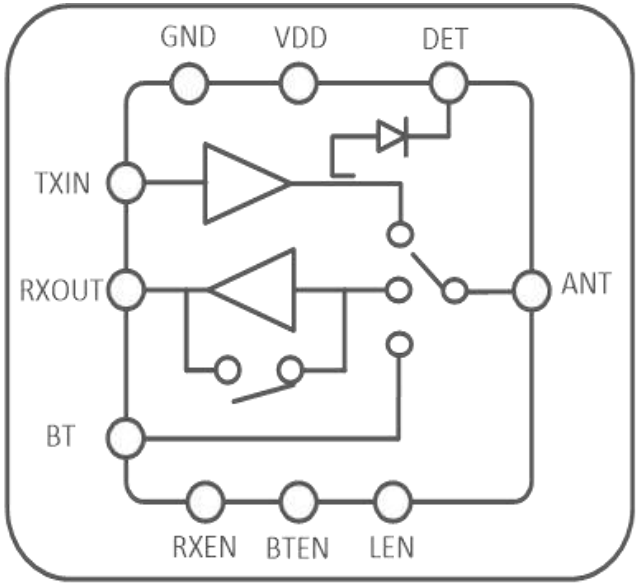
# RFX8422S CMOS Single-Chip/Single-Die 2.4GHz RFeIC with PA, LNA & SP3T for Dual-Mode WiFi/Bluetooth Operation in Mobile Devices

## Evaluation Board Test Results Summary & Technical Notes

# RFX8422S 2.4GHz WLAN/BT RFeIC with PA, LNA, SP3T

## Functional Block Diagram



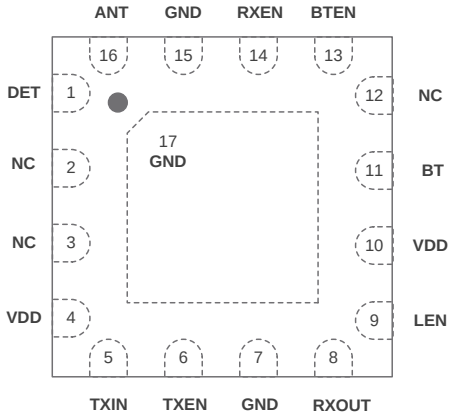

## Product Overview

- Pure CMOS Single-Chip, Single-Die RF Front-End IC
- PA + LNA + SP3T Switch + Harmonic Filters
- High Linearity PA 802.11n/ac WLAN & BT
- Low Noise Figure WLAN Receive LNA with Bypass for Near Range Operation
- 2.4 – 2.5 GHz Frequency Band
- Direct Battery Operation
- Complete On-Chip RF Decoupling and DC Block Capacitors – No External Inductors
- 2.5mm x 2.5mm x 0.45 mm, 16L QFN Package

## RFX8422S Applications

- Smartphones, Feature Phones and MIDs with WLAN/Bluetooth
- WLAN/Bluetooth Platforms Requiring Shared Antenna
- Laptop / Netbook / Smartbook with Embedded WiFi & Bluetooth
- Portable Platforms with Integrated 802.11n/ac and Bluetooth

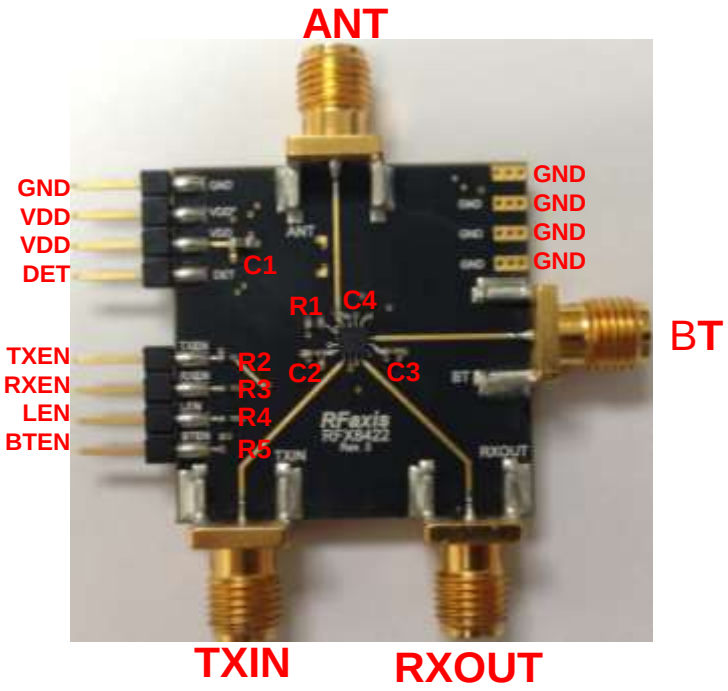
# RFX8422S Pin-out and Pin Description




(Top "See-Through" View)

| Pin Number | Pin Name | Description |
|---|---|---|
| 1 | DET | PA Power Detector Output |
| 2, 3, 12 | NC | Not Connected Internally. Can be Grounded or Left Open |
| 4, 10 | VDD | DC Voltage Supply |
| 5 | TXIN | WLAN TX Signal Port from the Transceiver: DC Shorted to GND |
| 6 | TXEN | CMOS Logic Control to Enable WLAN Transmit |
| 7, 15, Paddle | GND | Ground – Must be Connected to Ground |
| 8 | RXOUT | WLAN RX Signal Port to the Transceiver: DC Shorted to GND |
| 9 | LEN | CMOS Logic Control to Enable LNA. Use to switch between the LNA and Bypass modes |
| 11 | BT | RF signal Port from/to the Bluetooth Transceiver: DC Shorted to GND |
| 13 | BTEN | CMOS Logic Control to Enable Bluetooth |
| 14 | RXEN | CMOS Logic Control to Enable WLAN Receive |
| 16 | ANT | RF Signal Port to/from the Antenna: DC Shorted to GND |

# RFX8422S Eval Board, DC Bias and Control Logic




## Recommended BOM

| Designator | Value | Footprint | Notes |
|---|---|---|---|
| C1 | 2.2uF | 0402 | X5R/X7R |
| C2 | 220pF | 0402 | X5R/X7R |
| C3 | 1uF | 0402 | X5R/X7R |
| C4 | 0.3pF | 0402 | COG |
| R1 | 10KΩ | 0402 | Det. Load |
| R2, R3, R4, R5 | 1KΩ | 0402 | * |

* Only need if the control pin is directly connected to VDD.

## Control Logic Truth Table

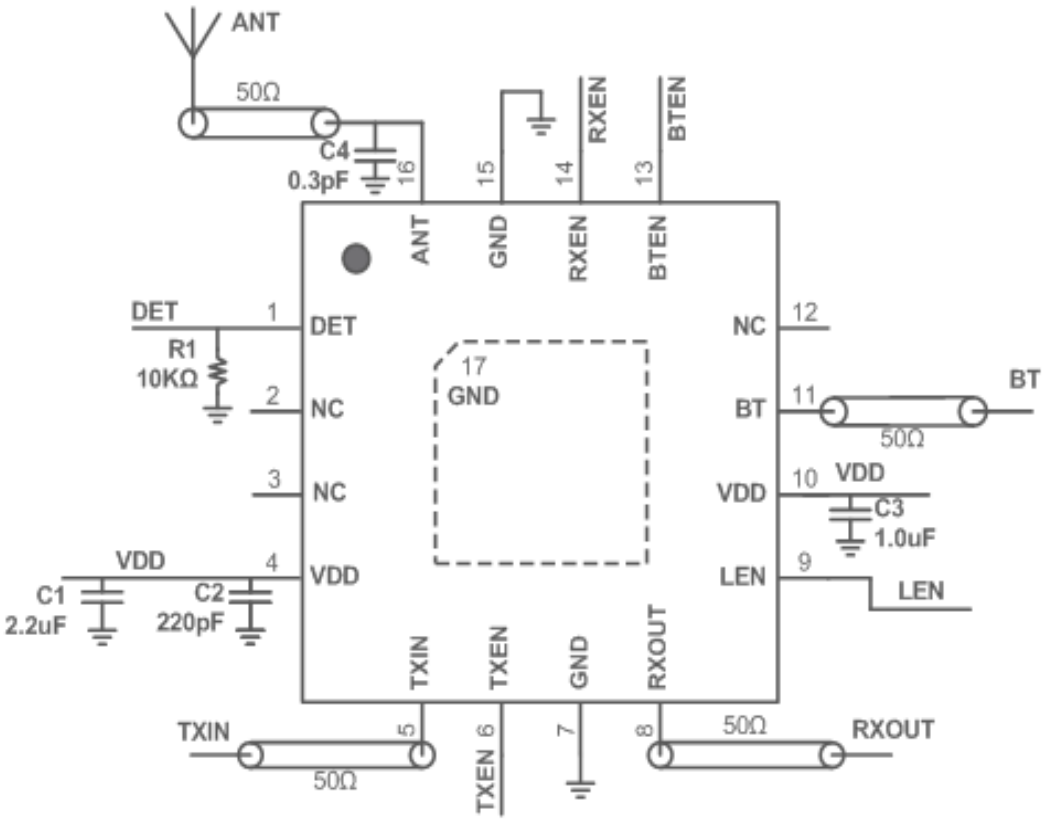
| TXEN | BTEN | RXEN | LEN | Mode of Operating |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | Shutdown Mode |
| 1 | 0 | 0 | 0 | WLAN Transmit Mode |
| 0 | 0 | 1 | 1 | WLAN Receive. High Gain Mode |
| 0 | 0 | 1 | 0 | WLAN Receive. Bypass Mode |
| 0 | 1 | 0 | 0 | Bluetooth Transmit/Receive Mode |

Note: "1" denotes high voltage state (> 1.2V) at Control Pins
"0" denotes low voltage state (< 0.3V) at Control Pins

## Evaluation Board Information:

- 4-Layer Stack, 10mil/40mil/10mil
- FR4 with εr=4.5, tan δ = 0.02 (Typ)
- RFIN, RFOUT trace losses are ~0.25dB @ 2.4GHz – 2.5GHz
- Results in following slides are referenced to device pins with the trace loss de-embedded
- VDD should be on before applying ctrl signals
-VDD Nominal 3.6 Vdc. Operational from 2.9 to 4.5 Vdc with limitations.

# Recommended Application Schematic and BOM




| Designator | Value | Footprint | Notes |
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| C1 | 2.2uF | 0402 | X5R/X7R |
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| C3 | 1uF | 0402 | X5R/X7R |
| C4 | 0.3pF | 0402 | COG |
| R1 | 10KΩ | 0402 | * |

* Detector Voltage will vary with different resistor loads.

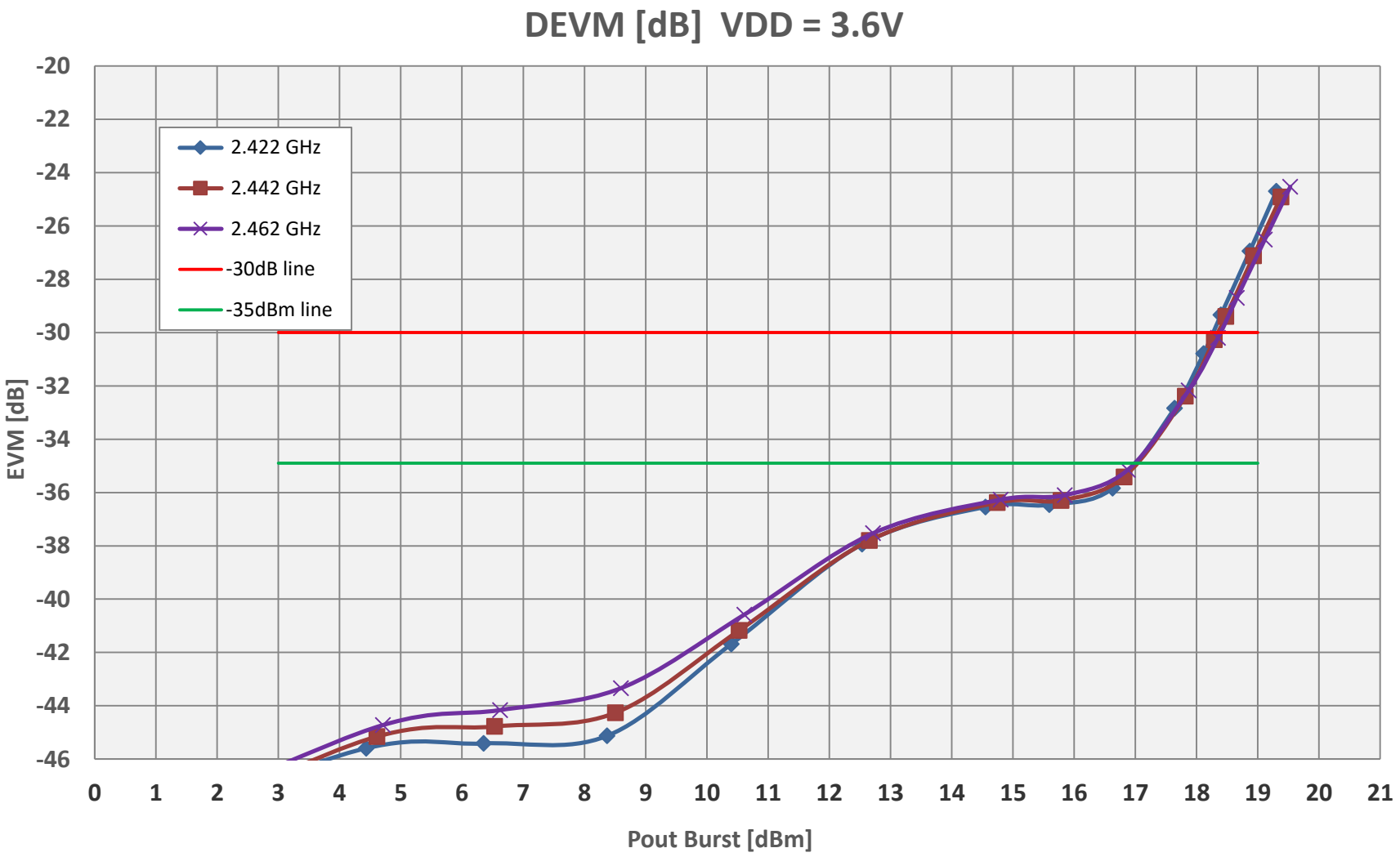
Nominal VDD = 3.6 Vdc
Operation from 2.9 to 4.5 Vdc with limitations

## EVB Signal Loss De-Embedding

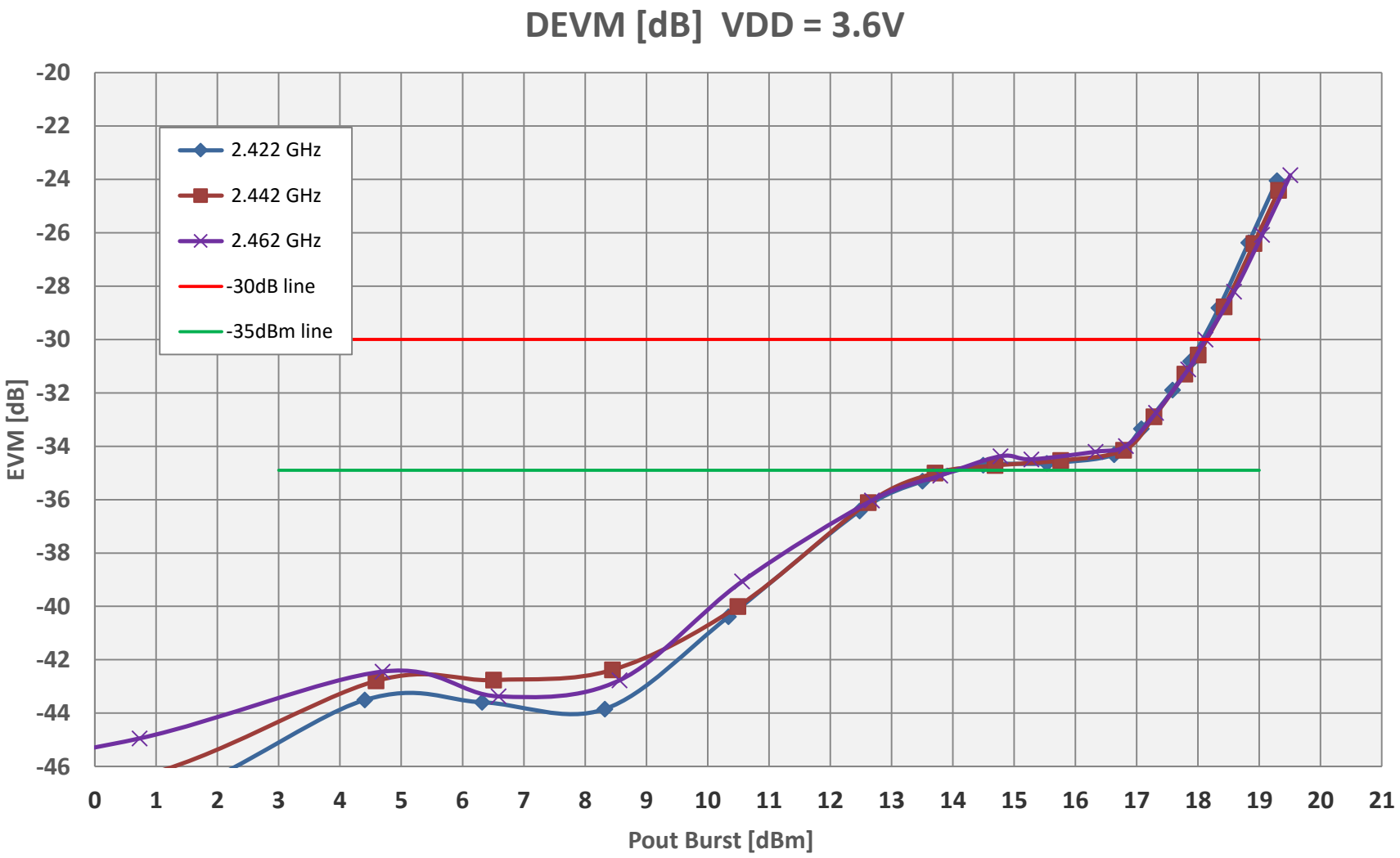
| RF Signal | Loss |
|---|---|
| ANT | .20 dB |
| TX | .20 dB |
| RX | .25 dB |
| BT | .25 dB |

**Total EVB Loss Includes the Trace and Connector**

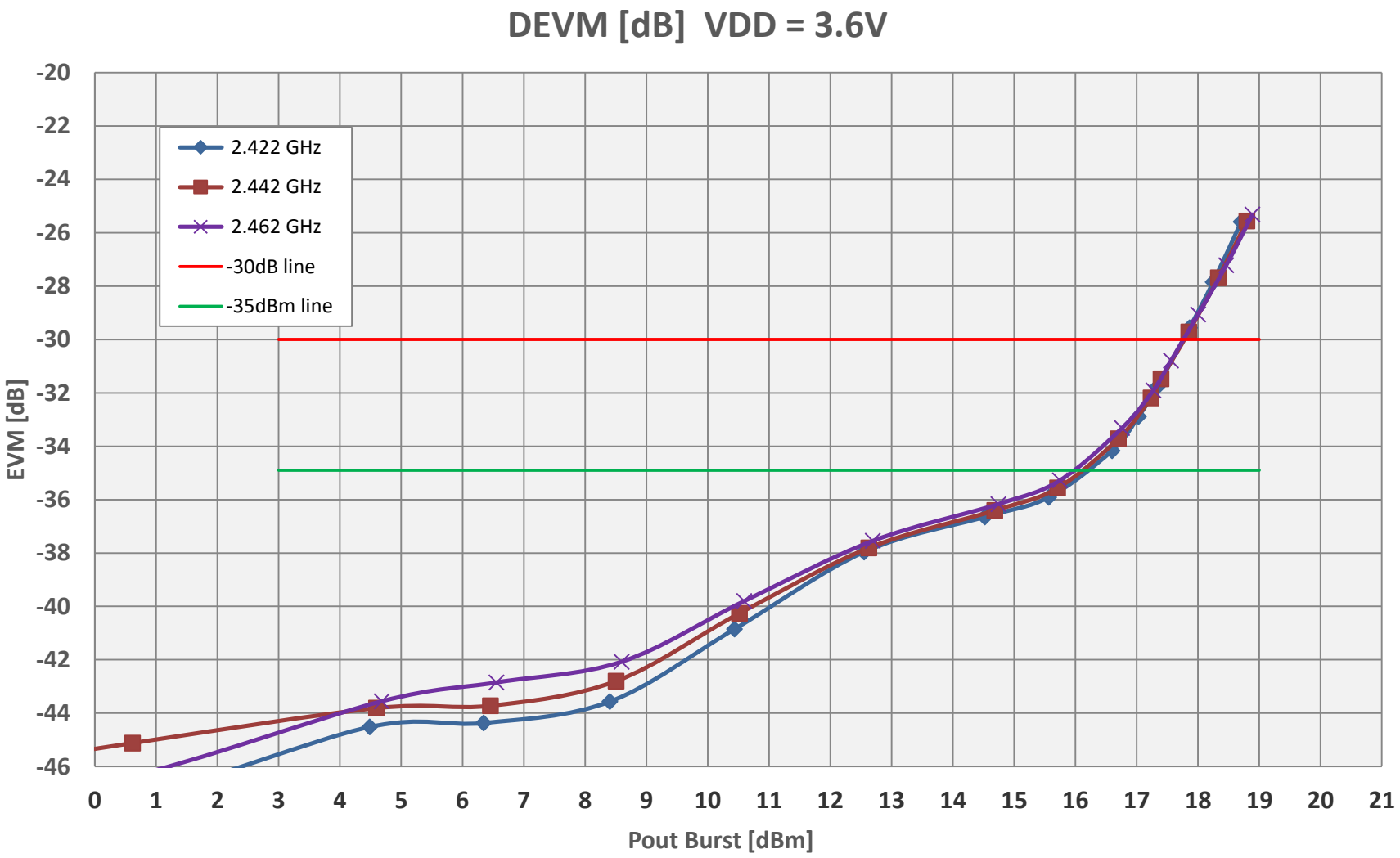
# RFX8422S DEVM vs. Output Power over Frequency
# 802.11g 64 QAM



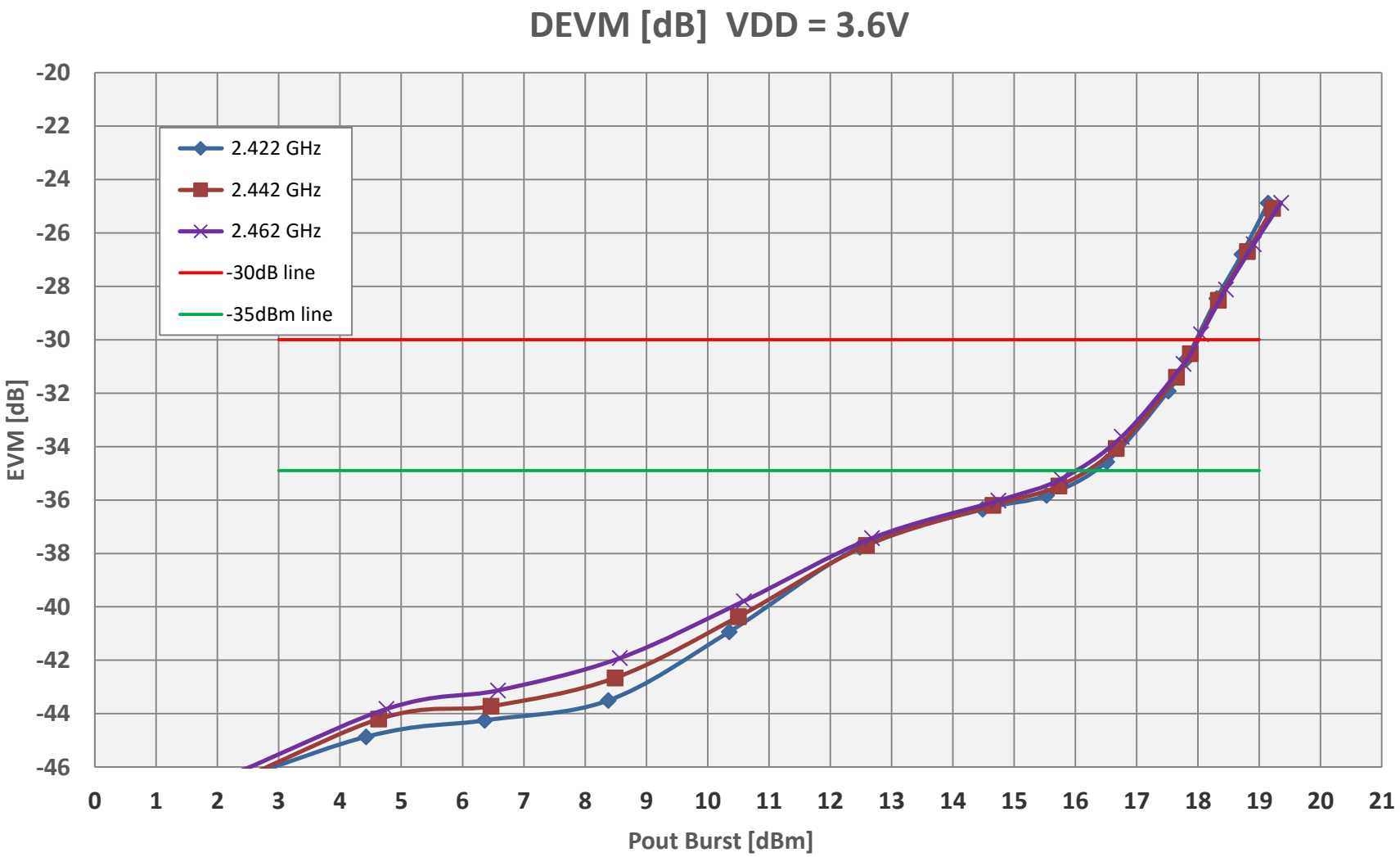
# RFX8422S DEVM vs. Output Power over Frequency
# 802.11n HT20 MCS7



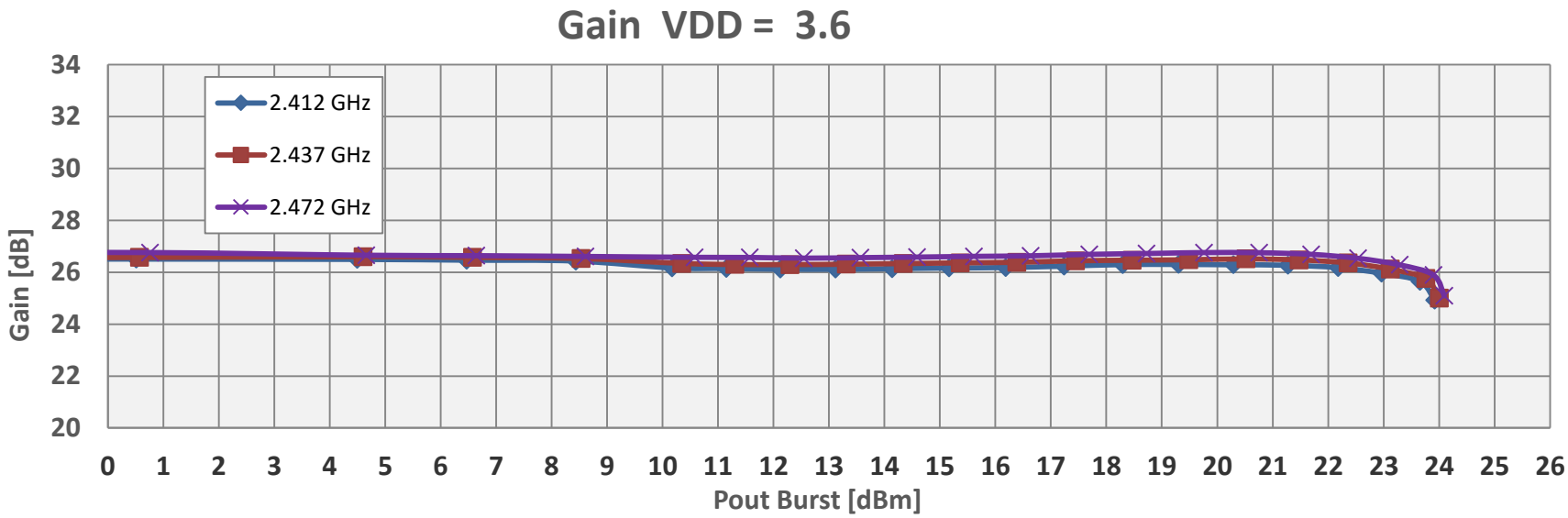
# RFX8422S DEVM vs. Output Power over Frequency
# 802.11n HT40 MCS7

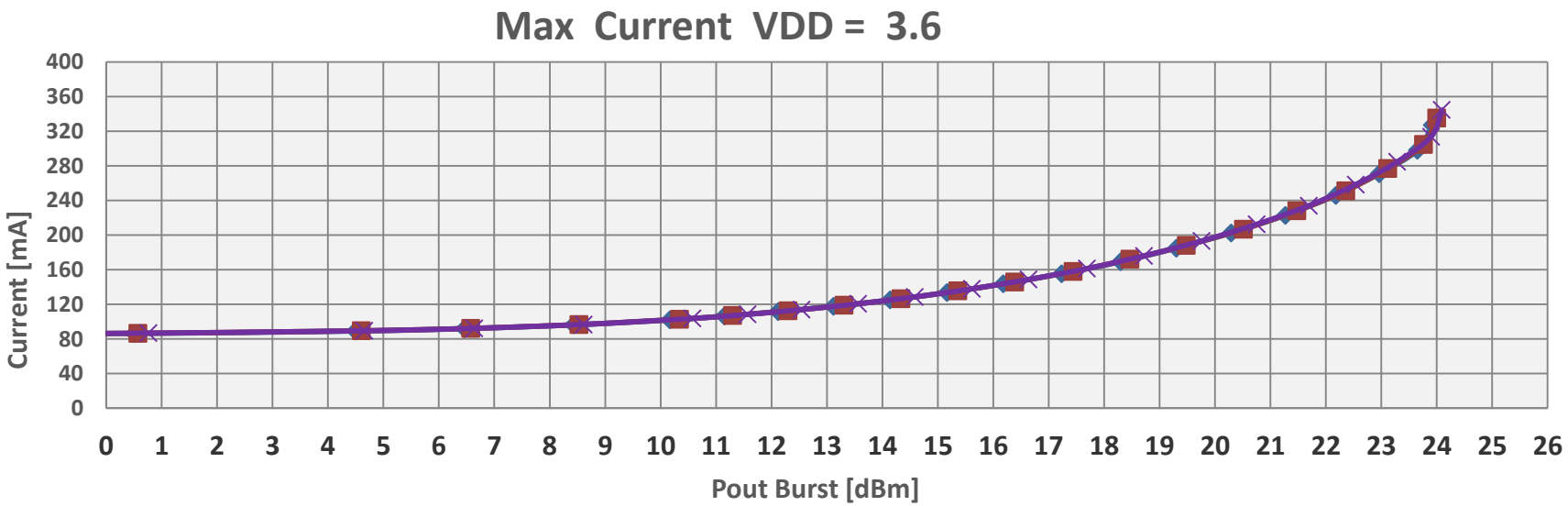


# RFX8422S DEVM vs. Output Power over Frequency
# 802.11ac VHT40 MCS9

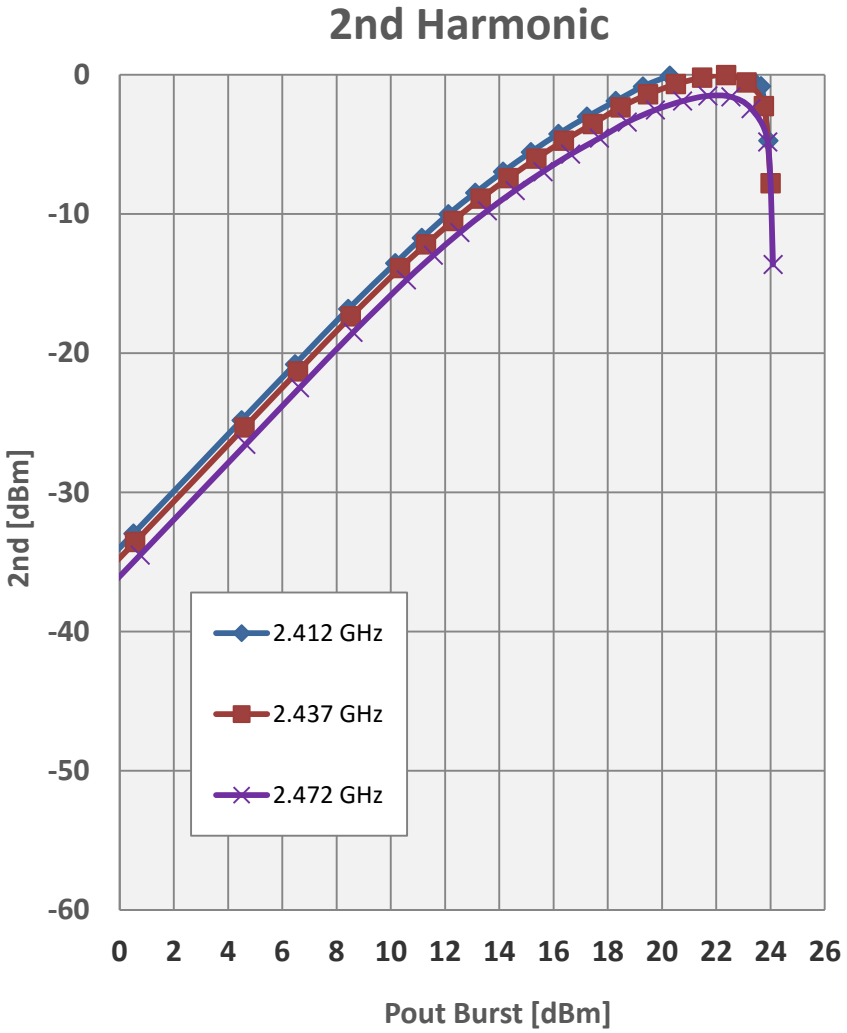


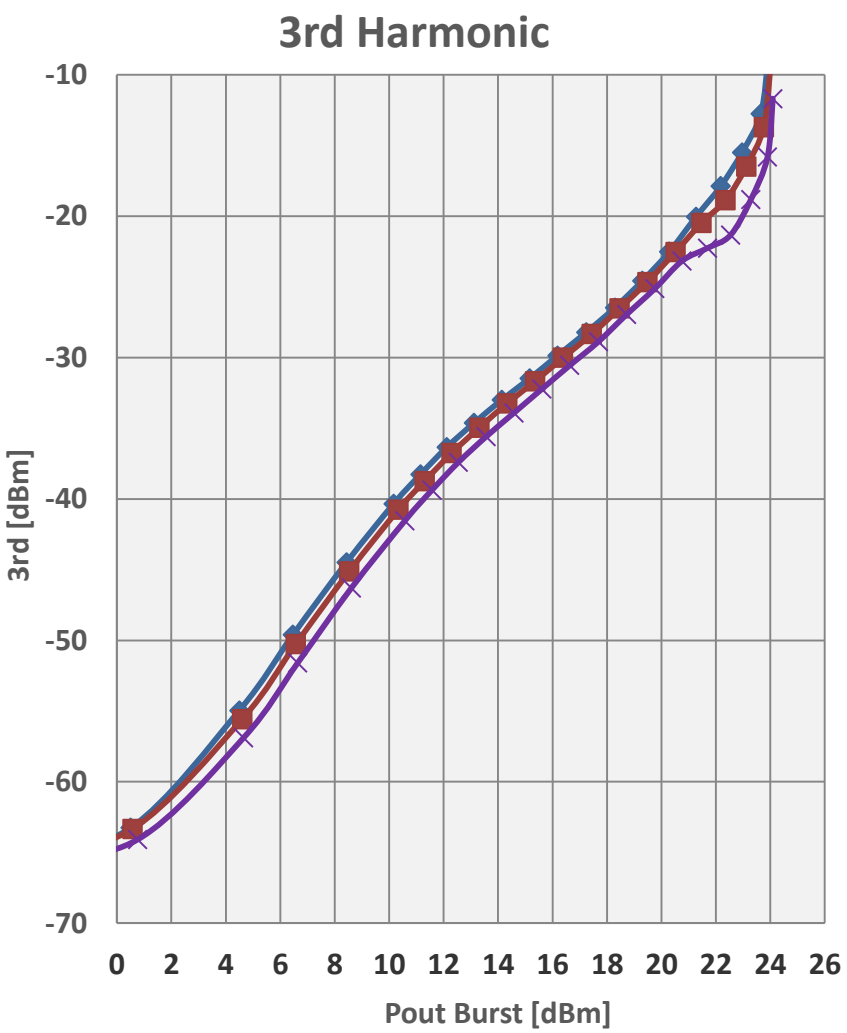
# RFX8422S Gain and Current over Frequency
# VDD = 3.6V



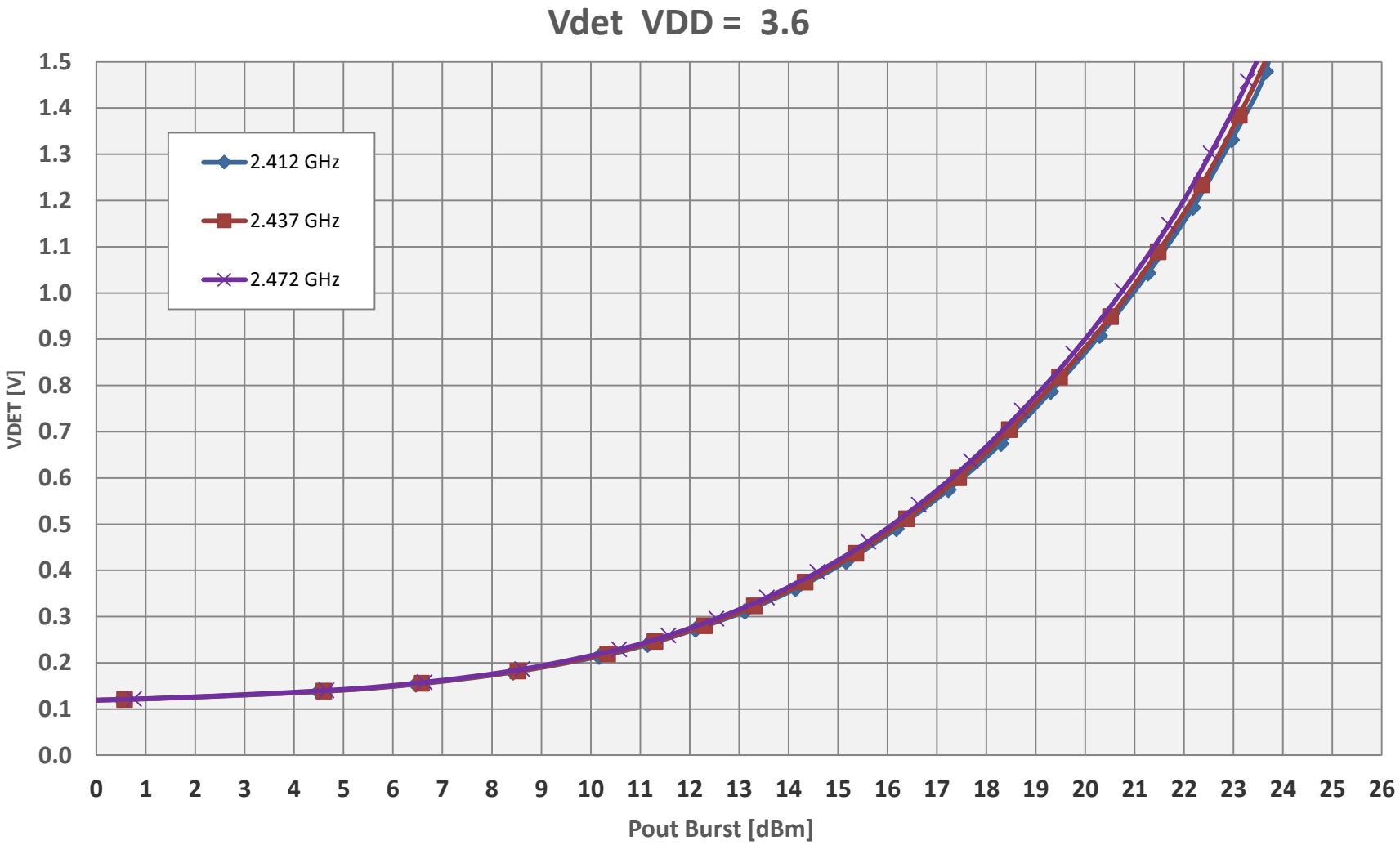



# RFX8422S CW Harmonics vs. Output Power over Frequency
## VDD = 3.6V



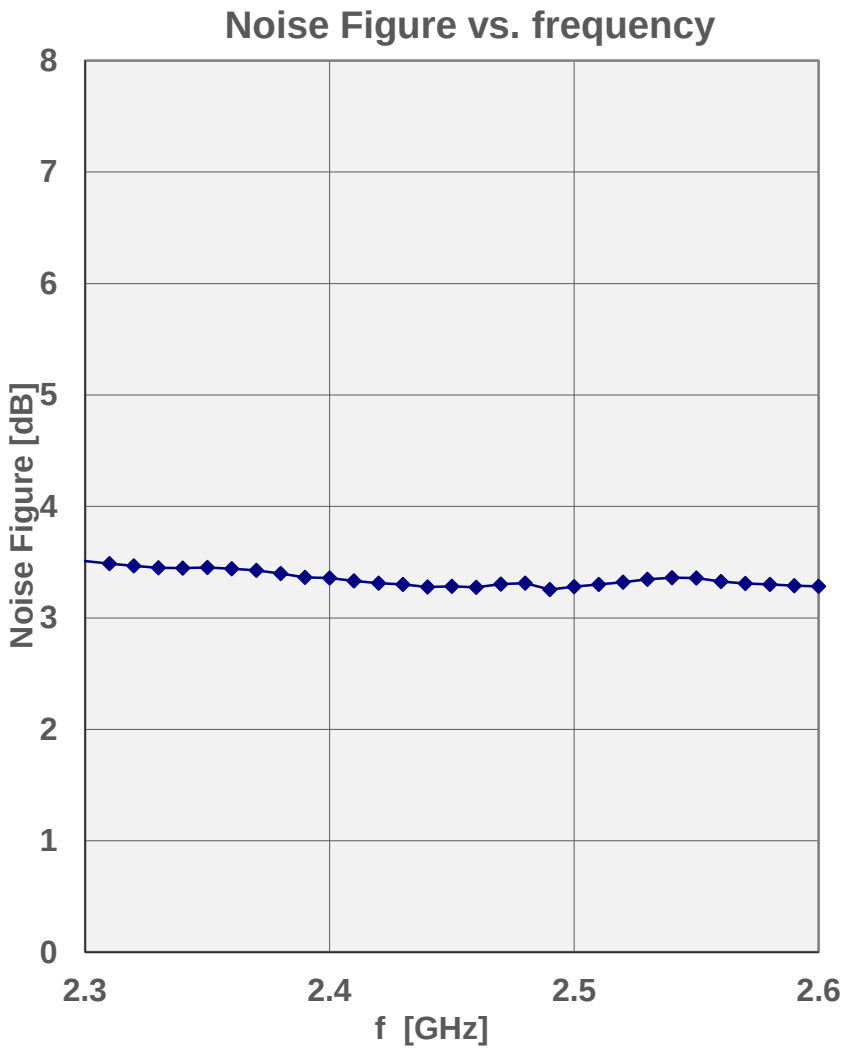



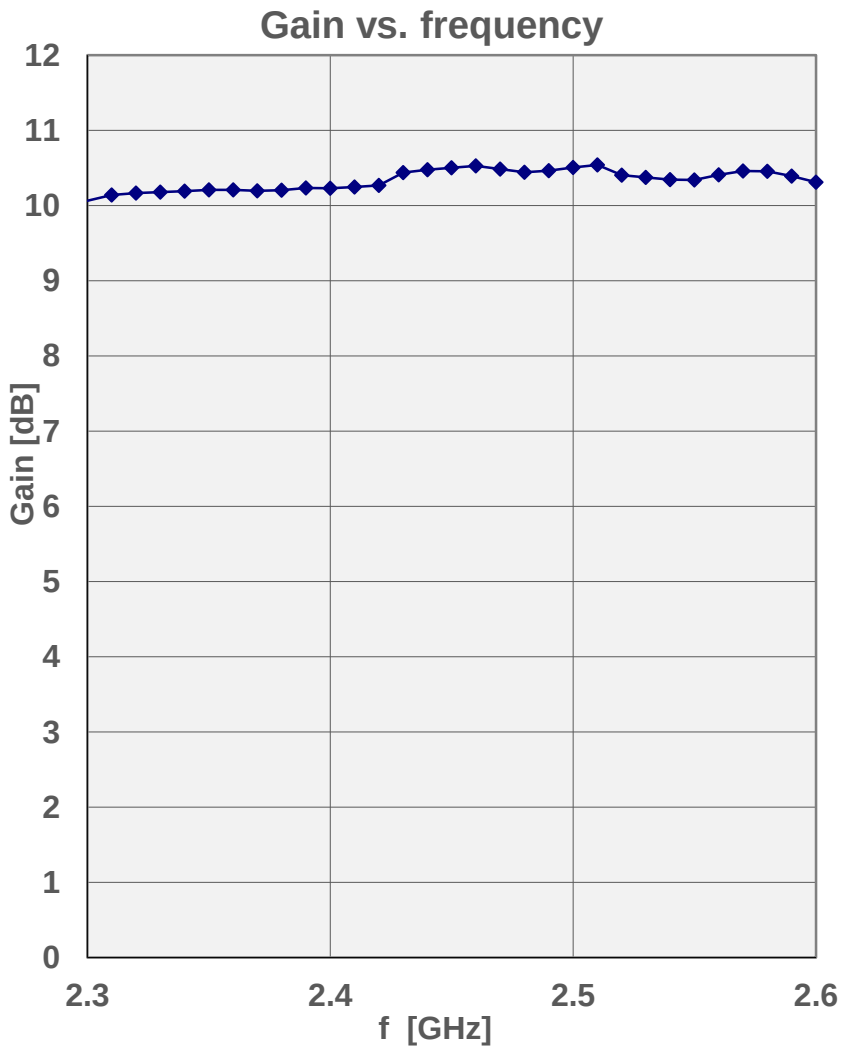
# RFX8422S Detector Output Voltage vs. Pout, over Frequency CW Signal




Detector voltage measured with 10kΩ load. Detector voltage will be vary with different resistor load values.

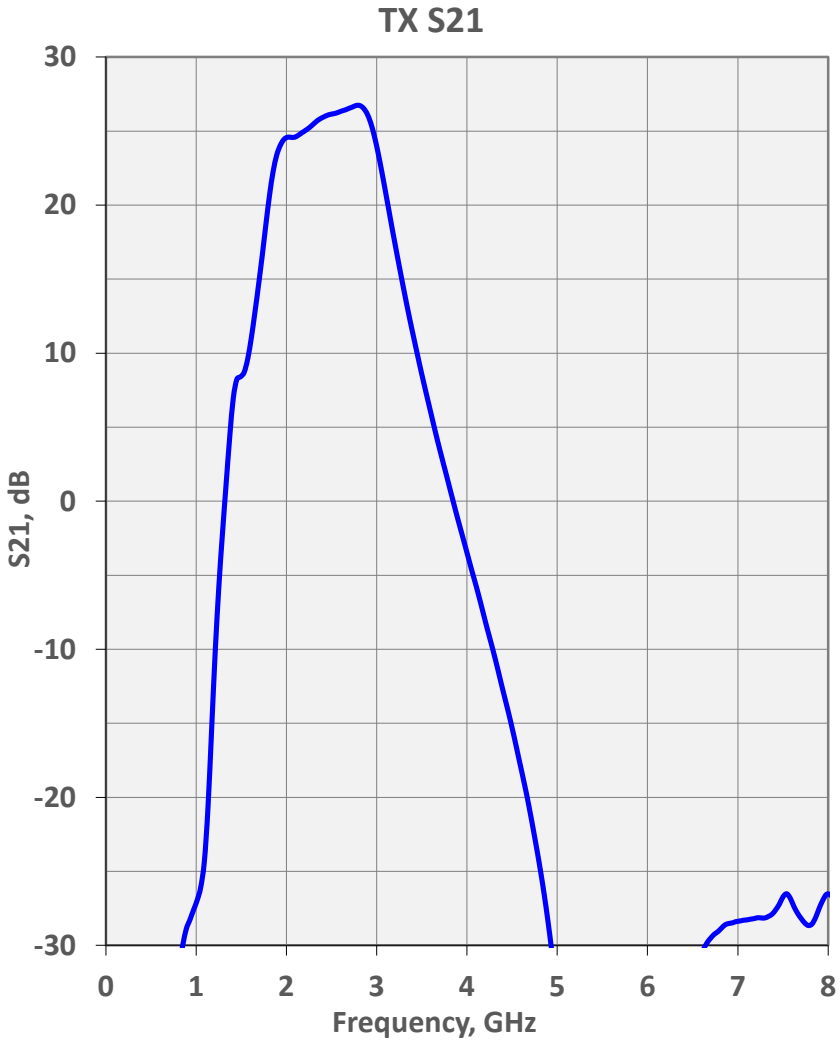
# RFX8422S LNA Gain and Noise Figure vs. Frequency
## VDD = 3.6V

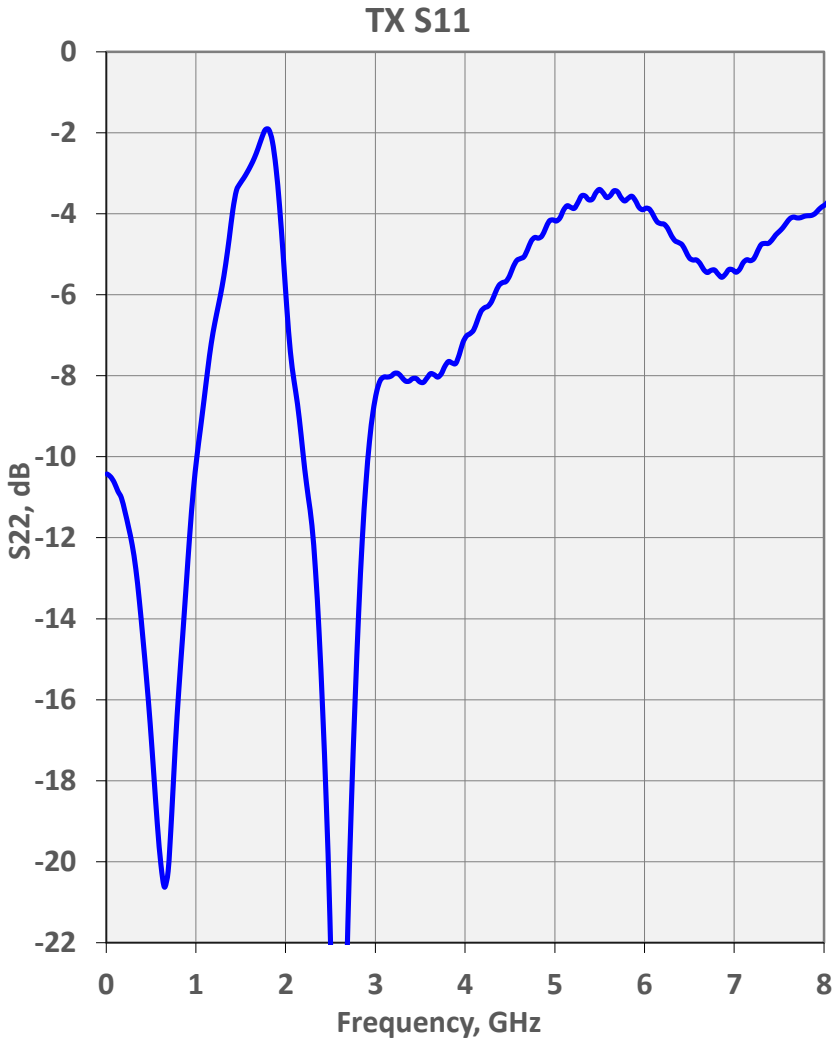



RXEN=High, LEN=High, TXEN=BTEN=Low, Iq= 12 mA

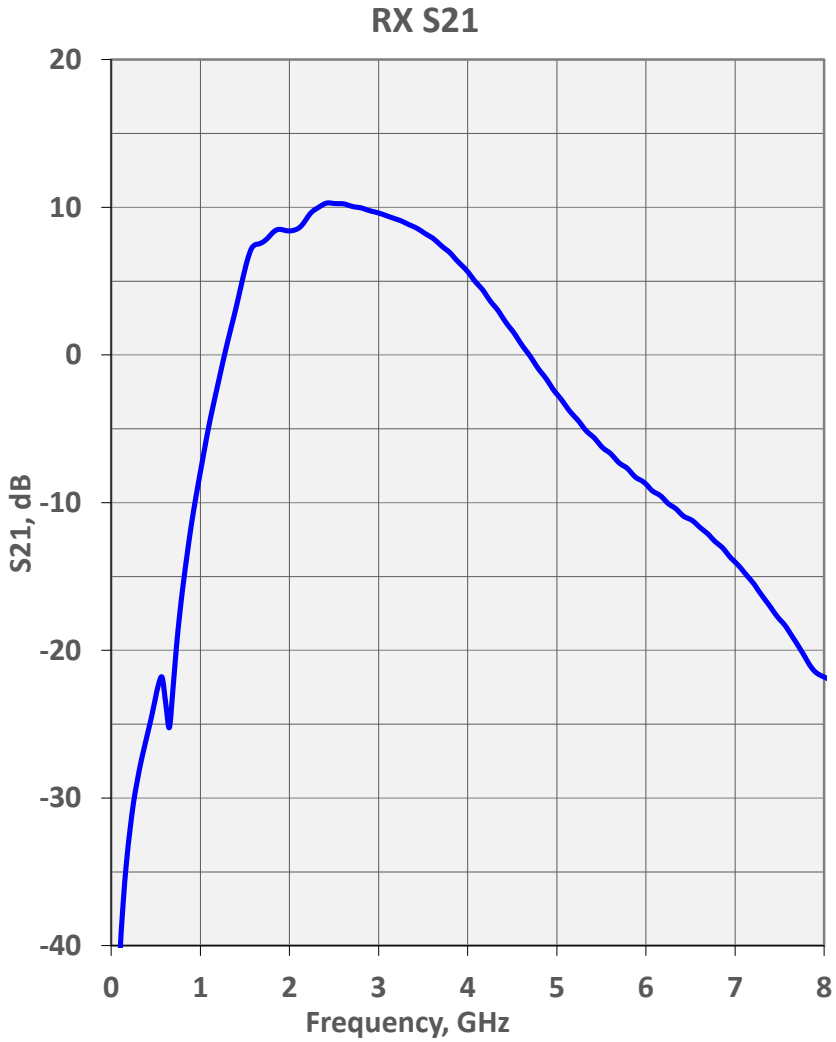
# RFX8422S TX Small-Signal S21, S11

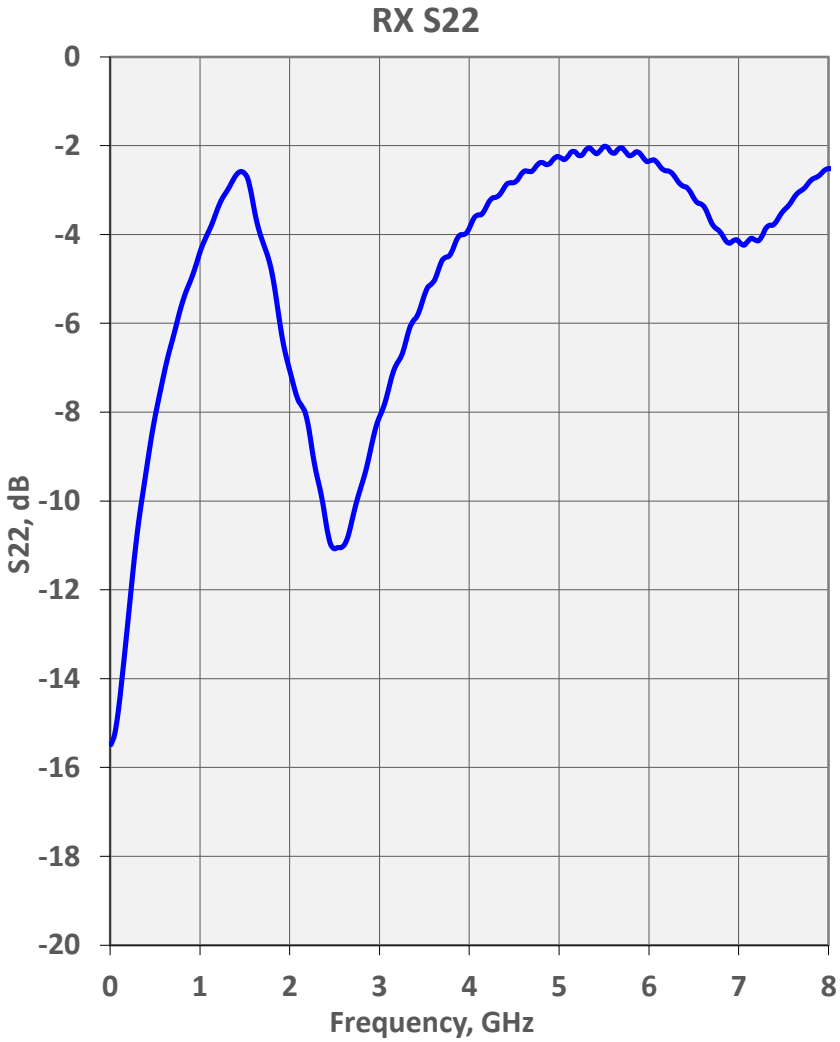



TXEN=High, RXEN=BTEN=Low, Icq~90mA @ VDD=3.6V

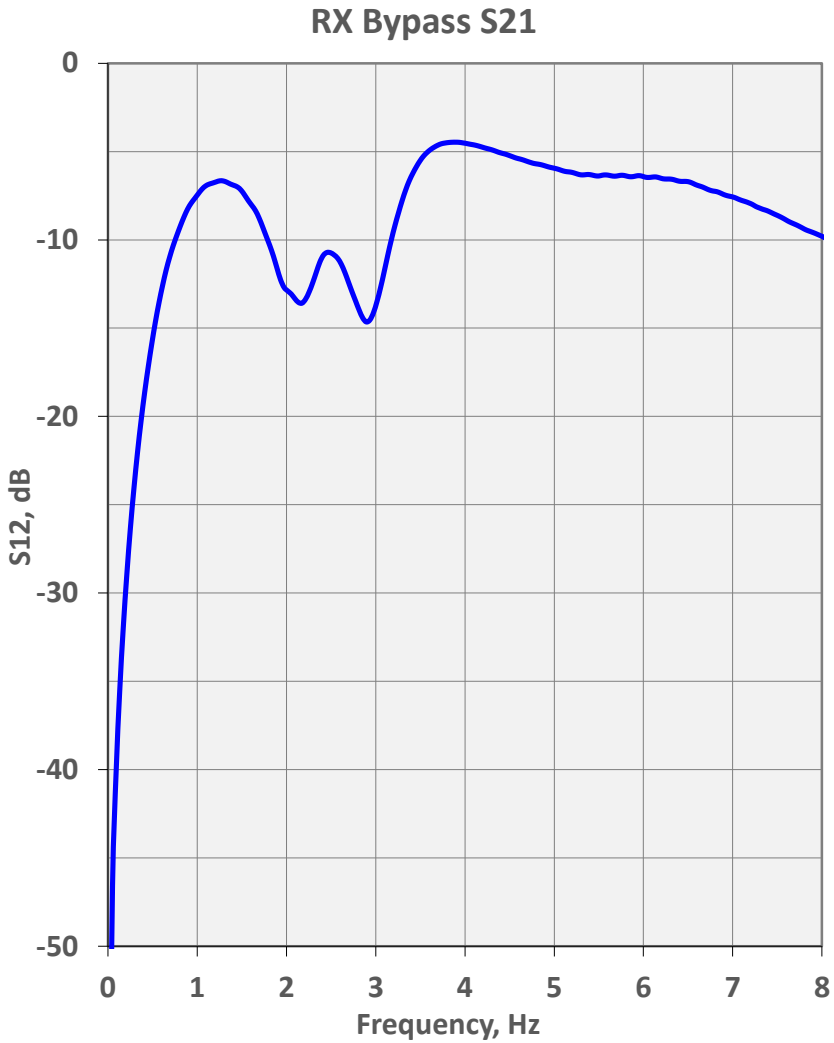
# RFX8422S RX Small-Signal S21, S22



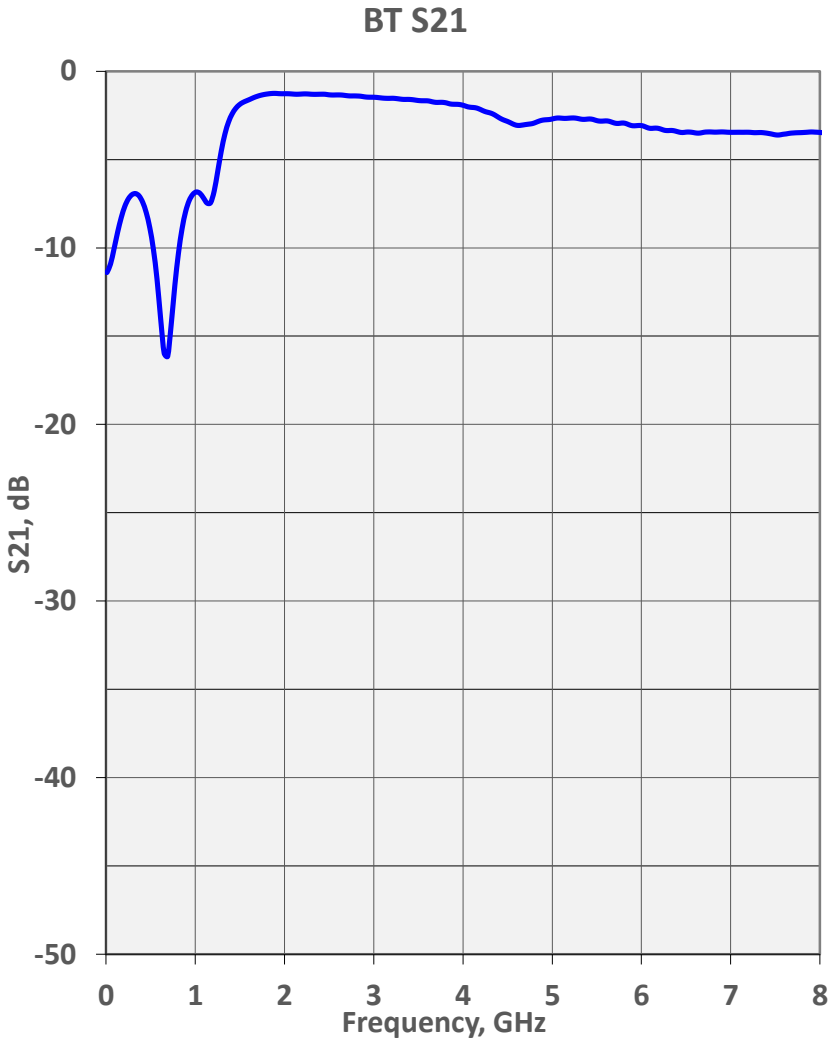




RXEN LEN=High, TXEN=BTEN=Low, LNA Iq= 12 mA

# RFX8422S RX Bypass and BT Small-Signal S21



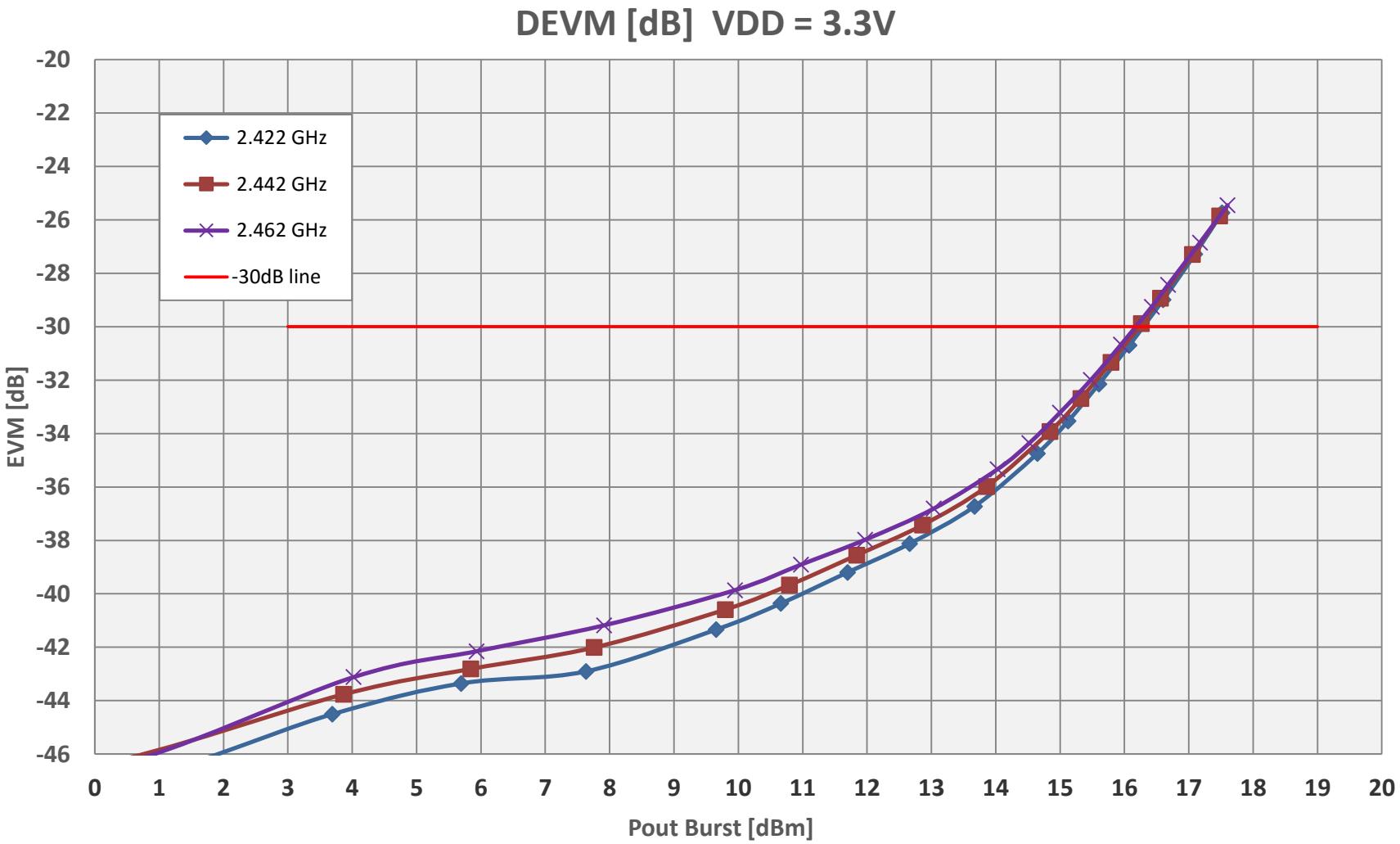

TXEN LEN BTEN=Low, RXEN=High, Iq= 1 mA



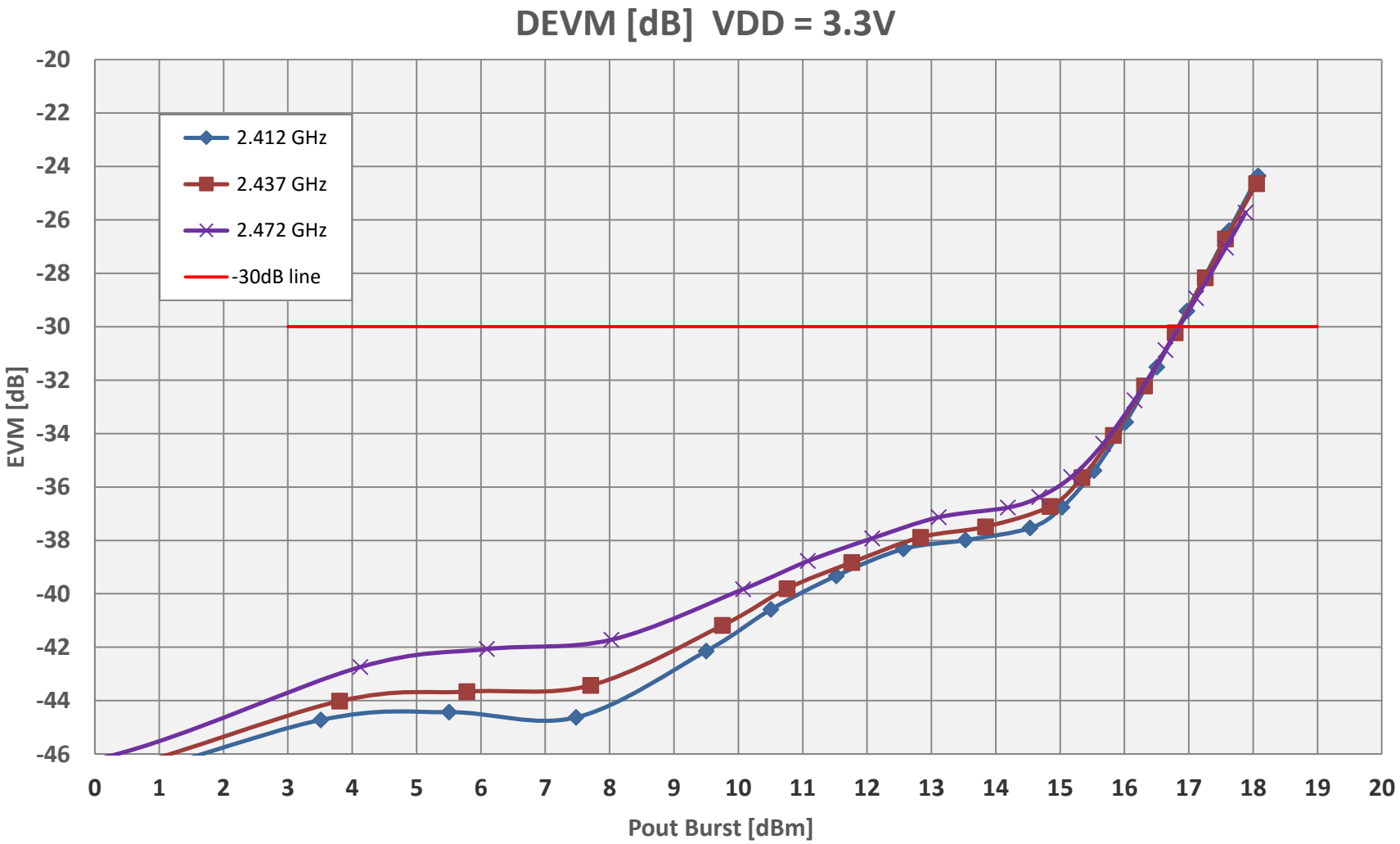

TXEN RXEN LEN=Low, BTEN=High, Iq= 1 mA

# RFX8422S
# VDD = 3.3V
# Supplemental Data

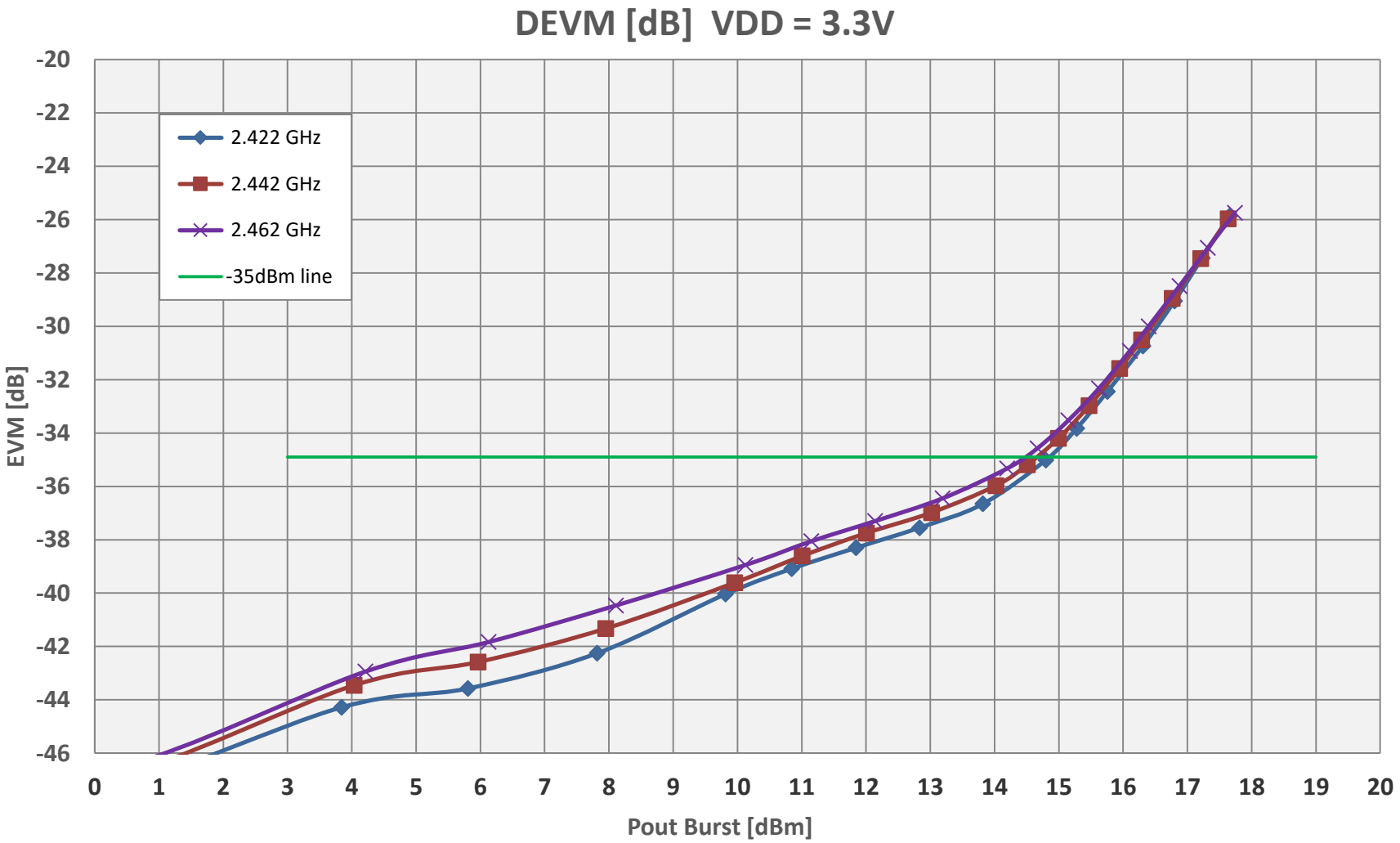
# RFX8422S DEVM vs. Output Power over Frequency
# 802.11n HT40 MCS7



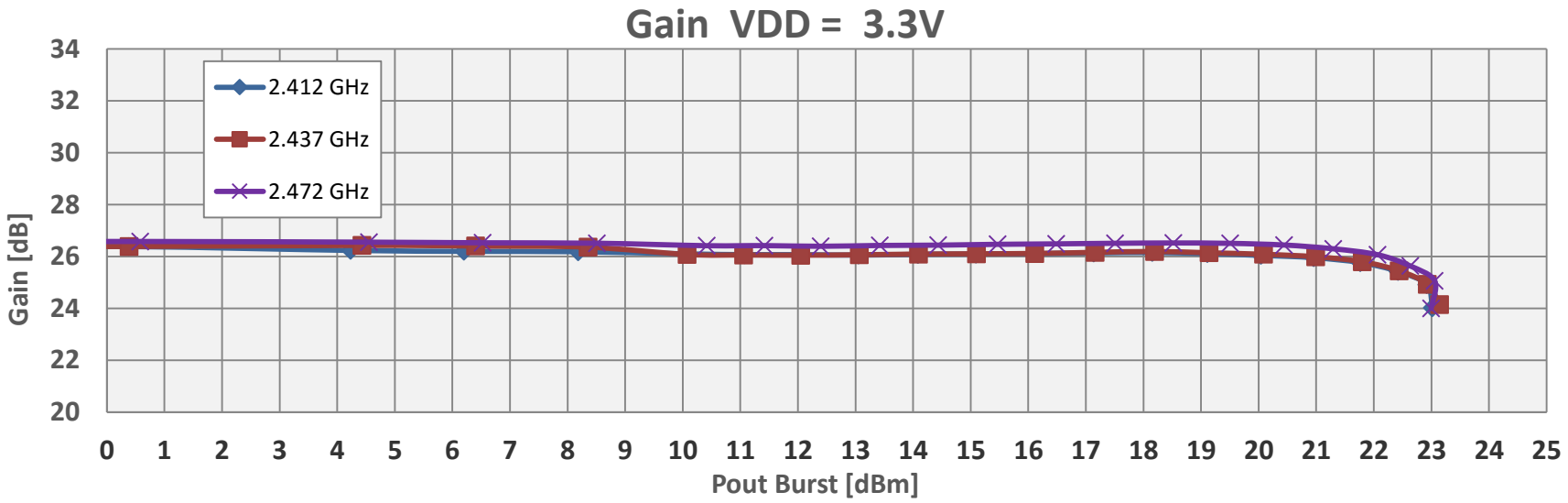
# RFX8422S DEVM vs. Output Power over Frequency
# 802.11n HT20 MCS7

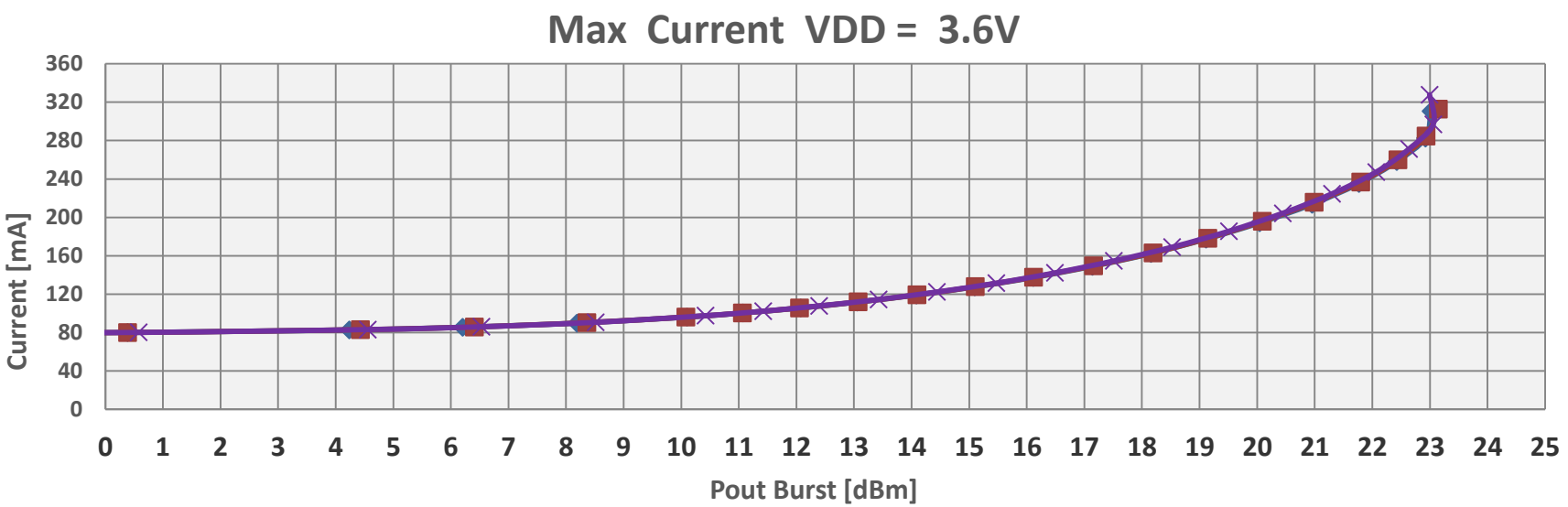


# RFX8422S DEVM vs. Output Power over Frequency
# 802.11ac HT40 MCS9

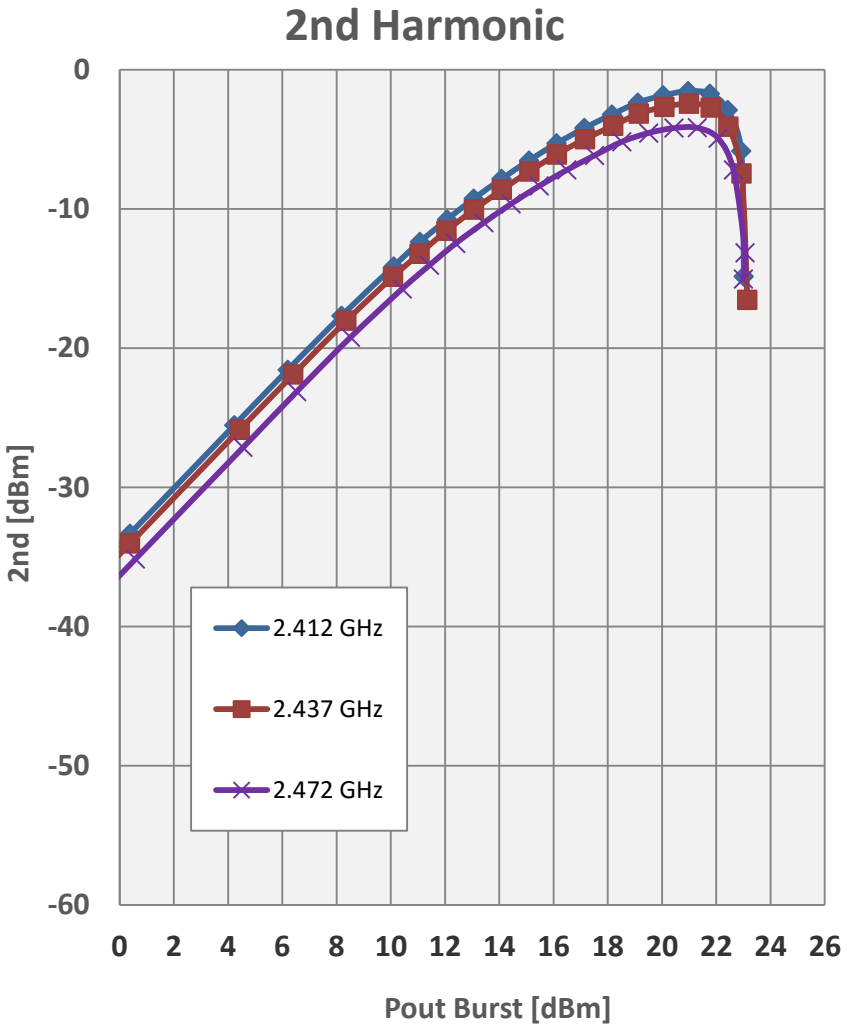


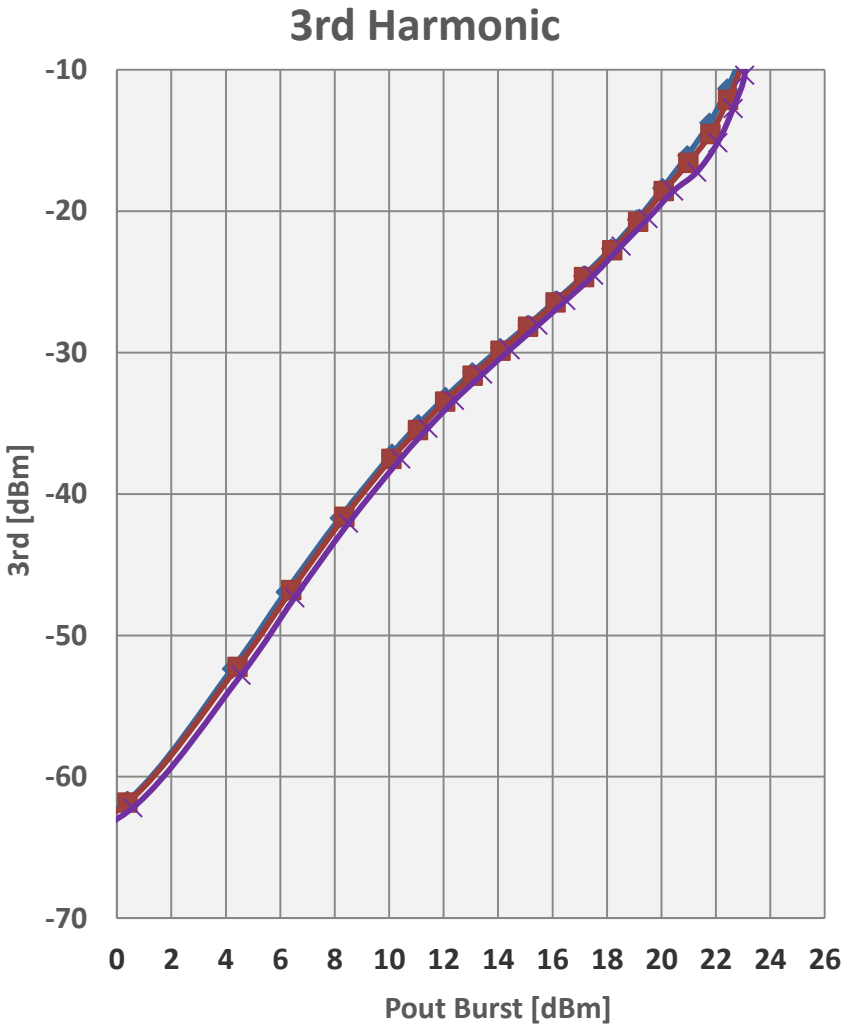
# RFX8422S CW Gain and Current over Frequency
# VDD = 3.3V



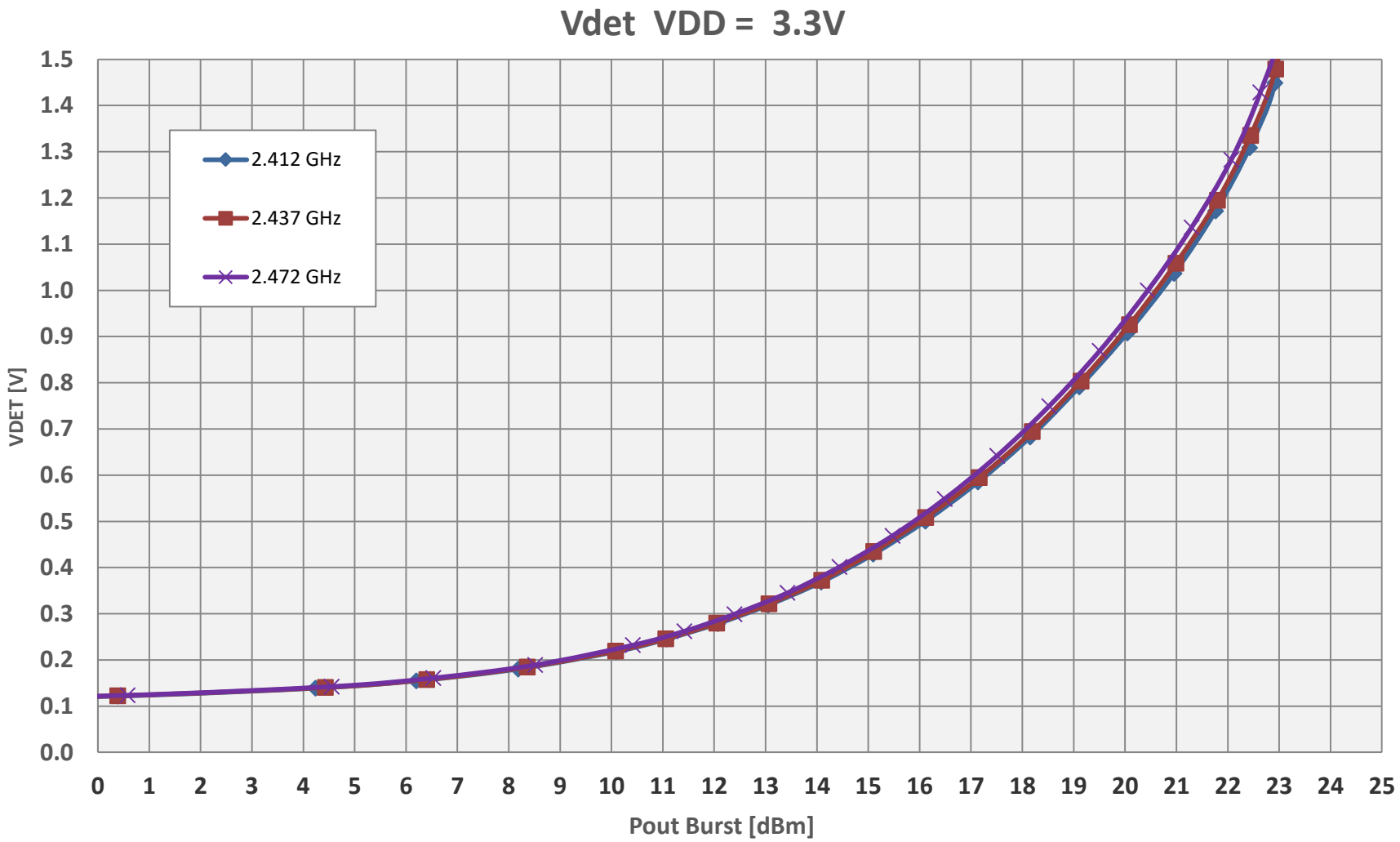



# RFX8422S CW Harmonics over Frequency
# VDD = 3.3V



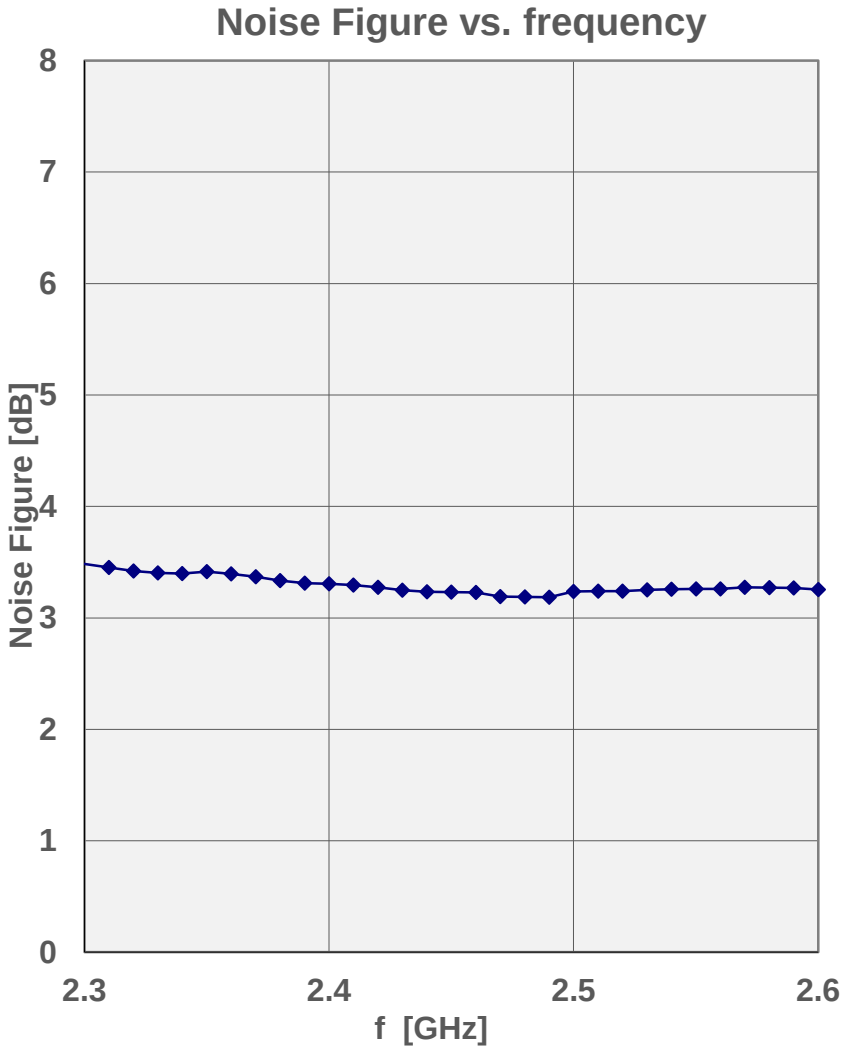



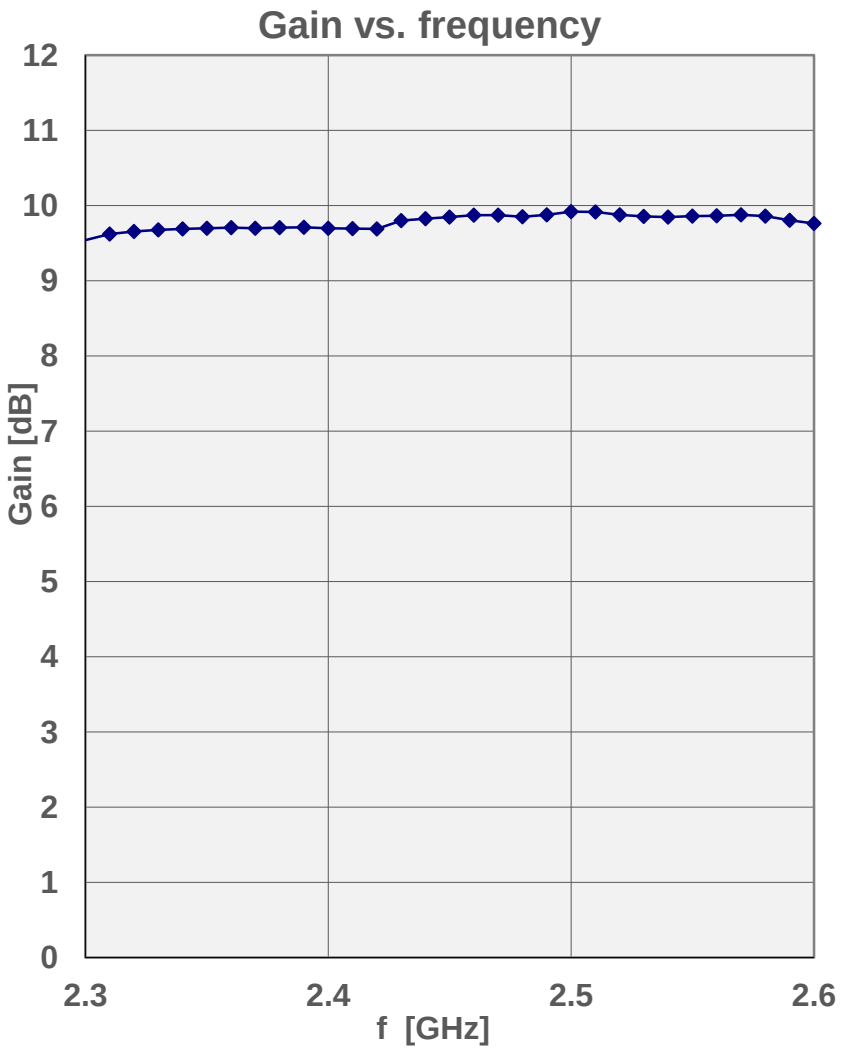
# RFX8422S CW Power Detector over Frequency
# VDD = 3.3V




Detector voltage measured with 10kΩ load. Detector voltage will vary with different resistor load values.

# RFX8422S LNA Gain and Noise Figure vs. Frequency
## VDD = 3.3V




RXEN=High, LEN=High, TXEN=BTEN=Low, Iq= 11 mA