*Mobile Devices business*
*iDEN Mobile Devices Operations*

# RF Test Report

FCC Rule Parts: 90S and 24D
Industry Canada: RSS-Gen, RSS-119, RSS-134

**Product Name: i680**
**FCC ID: IHDT56KD1**
**IC ID: 109O-KD1**

Date: September 21, 2009

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# Test Report Details

| | |
|---|---|
| Tests Performed by: | Motorola EMC Laboratory<br>Plantation, Florida<br>8000 W. Sunrise Blvd<br>Plantation, Florida 33322<br>Phone: (954) 723-5480<br>FAX: (954) 723-3803<br>FCC Registration Number: **91932**<br>Industry Canada Number: **IC109U-1** |
| | TIMCO Engineering<br>Laboratory details in report<br>FCC Registration Number: **95517**<br>Industry Canada Number: **2056A** |
| Product Type: | Cellular Phone |
| Signaling Capabilities: | iDEN 800 MHz, iDEN 900 MHz |
| FCC ID: | IHDT56KD1 |
| IC ID: | 109O-KD1 |

# Applicable Standards

All tests and measurements indicated in this document were performed in accordance with the United States Code of Federal Regulations, Title 47 Part 2, Sub-part J, as well as the following parts:

| | |
|---|---|
| **X** | Part 90 Subpart S – Private Land Mobile Radio Service. |
| **X** | Part 24 Subpart D – Personal Communications Services. |
| **X** | RSS-119 – Land Mobile and Fixed Radio Transmitters and Receivers Operating in the Frequency Range 27.41-960 MHz. |
| **X** | RSS-134 – 900 MHz Narrowband Personal Communications Services. |

Applicable Standards: TIA/EIA-603-A, TIA/EIA-603-B, and ANSI C63.4-2003

# Exhibit 6a.1. Part 90/Part 24 Measured Data -- Pursuant 47 CFR. 2.1046; RSS-Gen Section 3, RSS-119 Section 5.4, RSS-134 Section 6.2.

### 6a.1.1 Land Mobile Transmitter Power

The transmitter is a variable power type used in a SMR trunking system. Output power (as defined in 47 CFR 90.7 and/or §24.132) is dynamically controlled as described in Exhibit 12.

### 6a.1.2 Maximum Output Power Rating -- Pursuant 47 CFR 2.1033(c)(7), §90.635(d), and §24.132(a)

Maximum output power rating: 640 milliwatts (28.06 dBm), pulse average power. Output power will vary from 0.22 to 640 milliwatts (pulse average power).

*Note 1: Nominal output power rating: 600 milliwatts (27.78 dBm) (Pulse average power).*

*Note 2: These ratings are compliant with the FCC maximum of 100 watts (50 dBm) for Mobile stations operating under Part 90.*

*Note 3: These ratings are compliant with the FCC maximum of 7 watts ERP for Mobile stations operating under Part 24.*

*Note 4: The term pulse average power is used to specify the power that would be measured during the intervals of recurrent TDM transmission pulses by an average responding RF power meter. Power expressed in this manner is independent of the TDM duty cycle, and facilitates RF system coverage analysis.*

### 6a.1.3 Operating output power range -- Pursuant 47 CFR 2.1033(c)(6)

Maximum tuned output power will vary over a range of 500 to 640 milliwatts (maximum pulse average power) to a minimum power of 34 dB below maximum tuned output power.

### 6a.1.4 DC power used by final amplifier device -- Pursuant 47 CFR 2.1033(c)(8)

In order to prevent the malfunctions that can occur due to directly measuring the DC characteristics of the final RF amplifying stage, data was obtained by measuring the entire radio DC current and is reported herein for the entire radio.

The DC current and the RF output power was measured with a special RF/DC test fixture set to supply the radio with the nominal battery voltage of 4V. The characteristics were measured during a transmission pulse and are listed in the Table below.

| **Characteristics** | **800 MHz** | | **900 MHz** | | **901.5 MHz** | |
|---|---|---|---|---|---|---|
| **Power Setting** | **minimum** | **maximum** | **minimum** | **maximum** | **minimum** | **maximum** |
| **DC Voltage (Volts)** | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| **DC Current (A)** | 0.55 | 1.16 | 0.55 | 1.15 | 0.55 | 1.15 |
| **Output Power (mW)** | 0.22 | 640 | 0.22 | 640 | 0.22 | 640 |

**Table 6a.1-1 Characteristics for 800 and 900 MHz SMR bands, and NBPCS Band**

# 6a.2. Modulation Characteristics and Necessary Bandwidth -- Pursuant 47 CFR §2.1047(d), §2.1049, §2.202, §90.210(g), §90.669(a), and §90.691; RSS-Gen Section 3, RSS-119 Section 4.2.

## 6a.2.1 Emission Designator 18K3D7W - iDEN 800 MHz Band Measured data

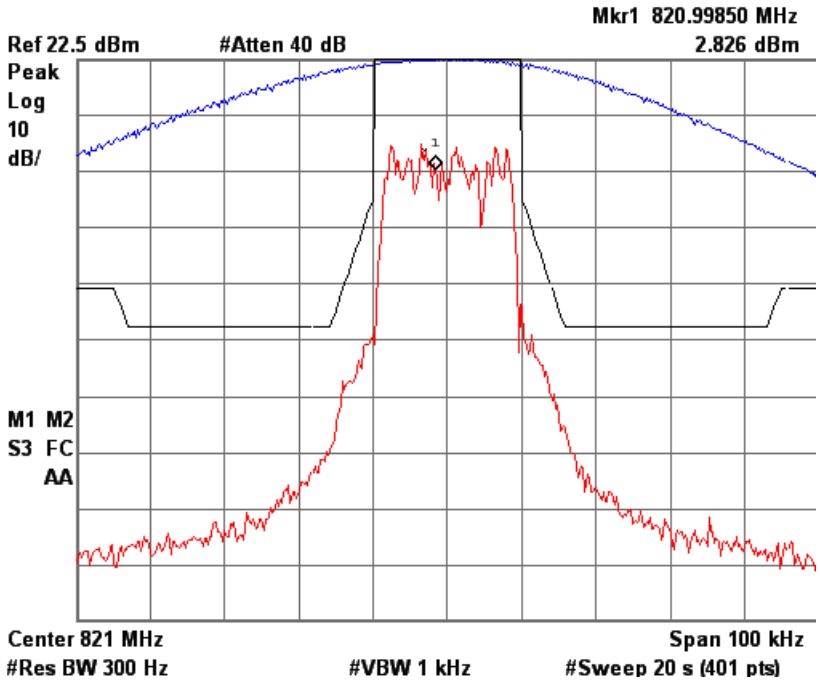


**Figure 6a.2.1-1. iDEN 800 MHz Band, Quad-QPSK, Maximum Power, Emission Mask G**

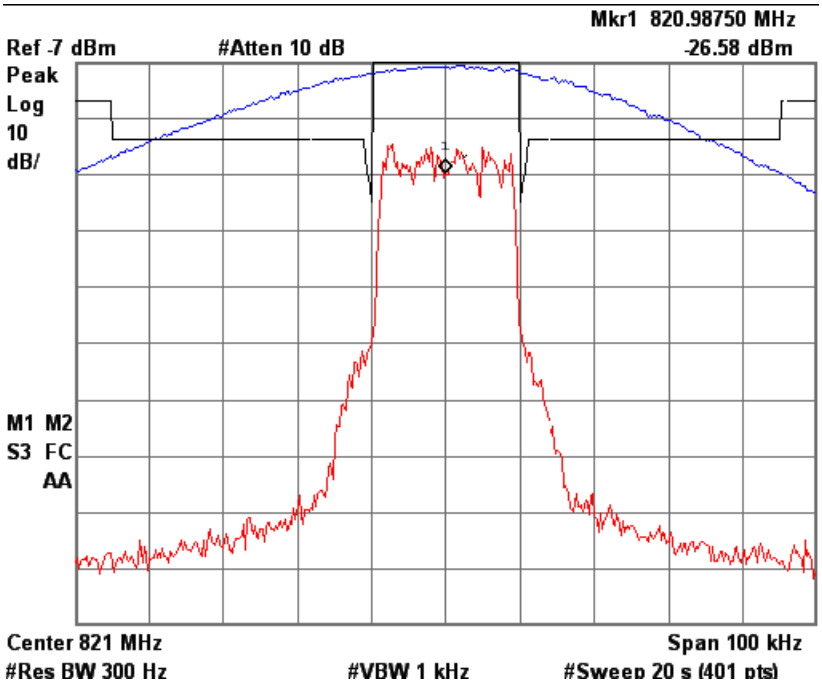


**Figure 6a.2.1-2. iDEN 800 MHz Band, Quad-QPSK, Minimum Power, Emission Mask G**

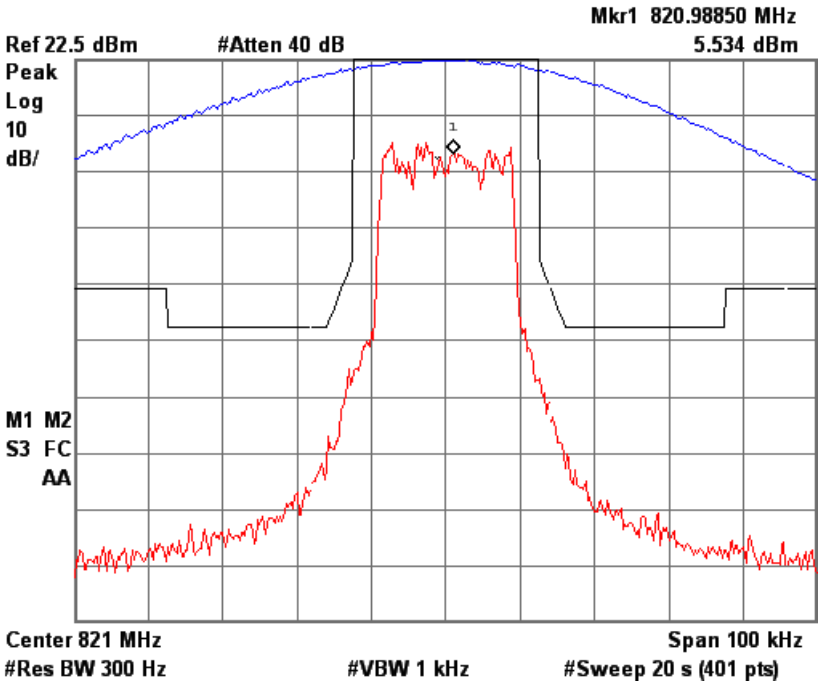


**Figure 6a.2.1-3. iDEN 800 MHz Band, Quad-QPSK, Maximum Power, EA Emission Mask**

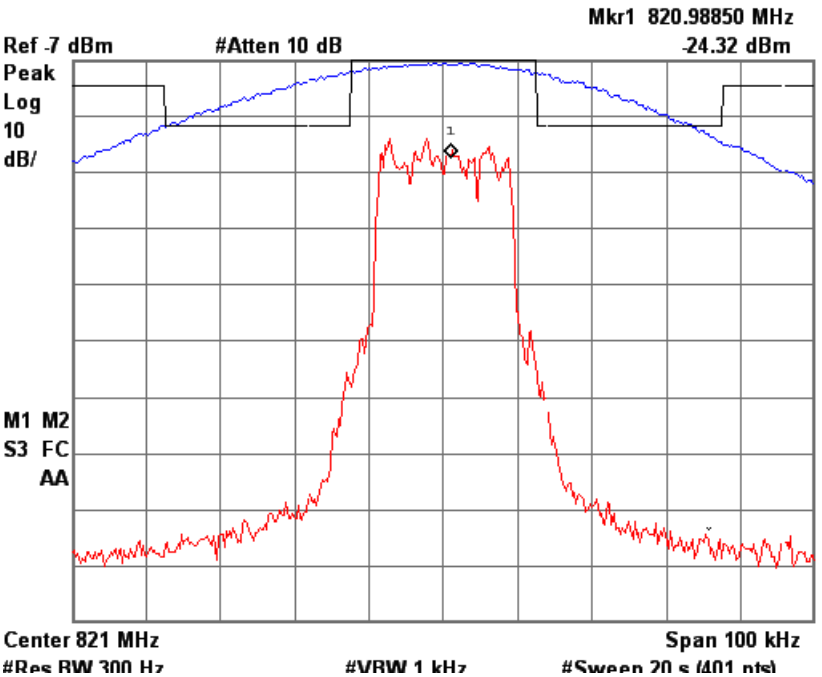


**Figure 6a.2.1-4. iDEN 800 MHz Band, Quad-QPSK, Minimum Power, EA Emission Mask**

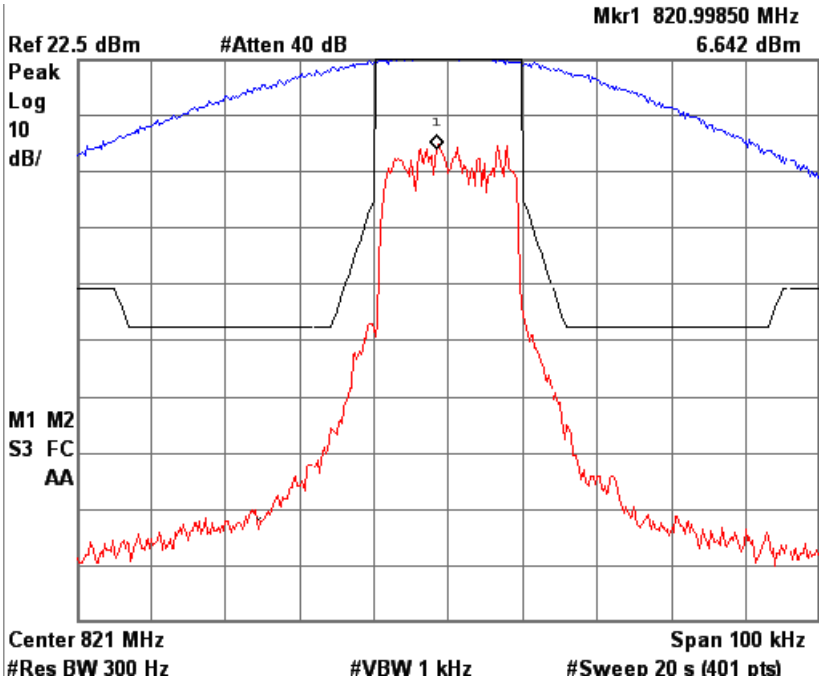


**Figure 6a.2.1-5. iDEN 800 MHz Band, Quad-16QAM, Maximum Power, Emission Mask G**

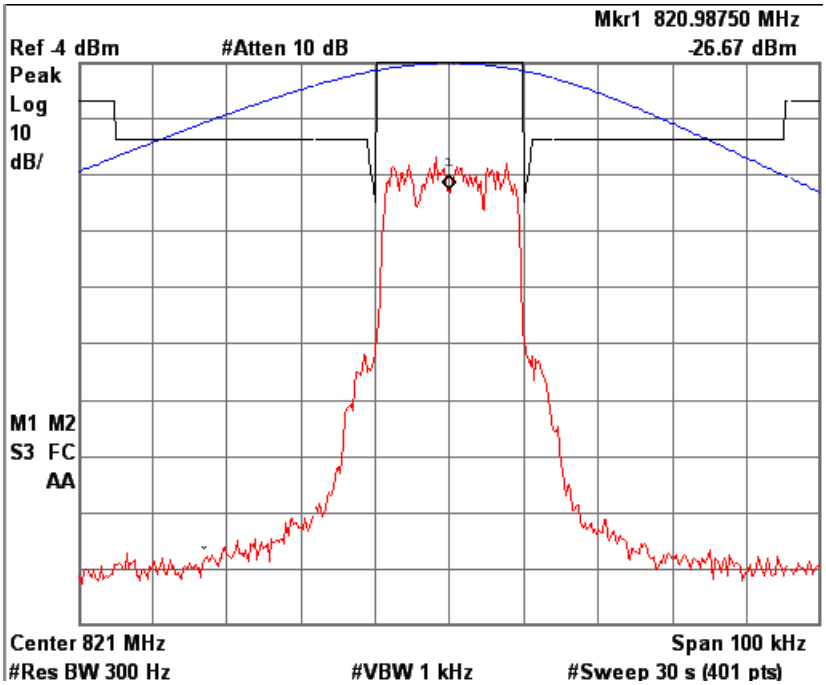


**Figure 6a.2.1-6. iDEN 800 MHz Band, Quad-16QAM, Minimum Power, Emission Mask G**

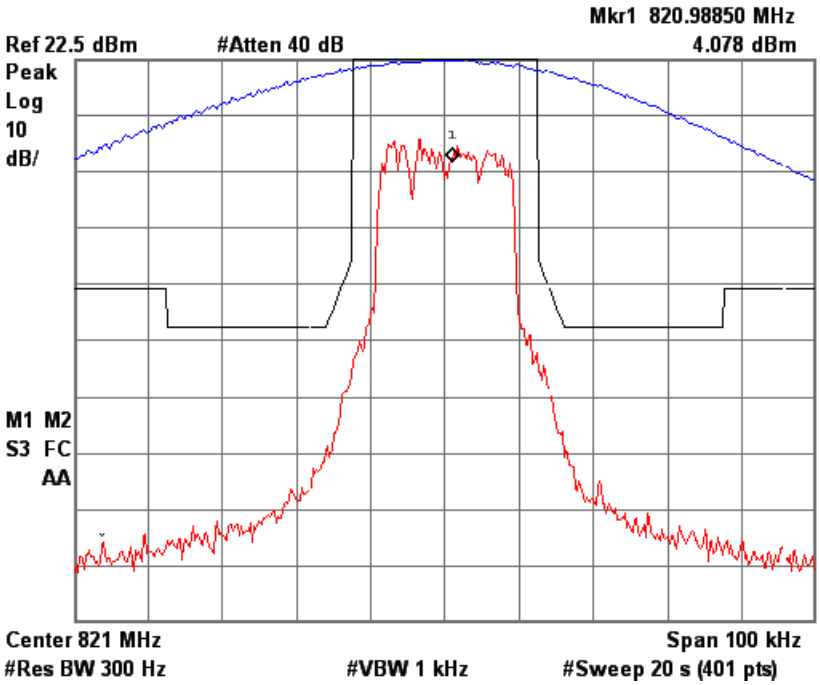


**Figure 6a.2.1-7. iDEN 800 MHz Band, Quad-16QAM, Maximum Power, EA Emission Mask**

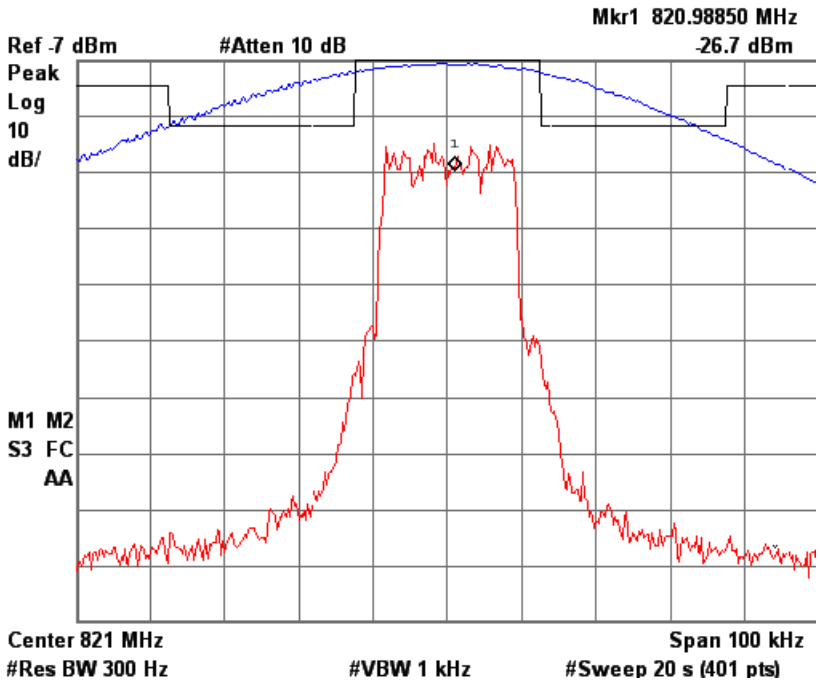


**Figure 6a.2.1-8. iDEN 800 MHz Band, Quad-16QAM, Minimum Power, EA Emission Mask**

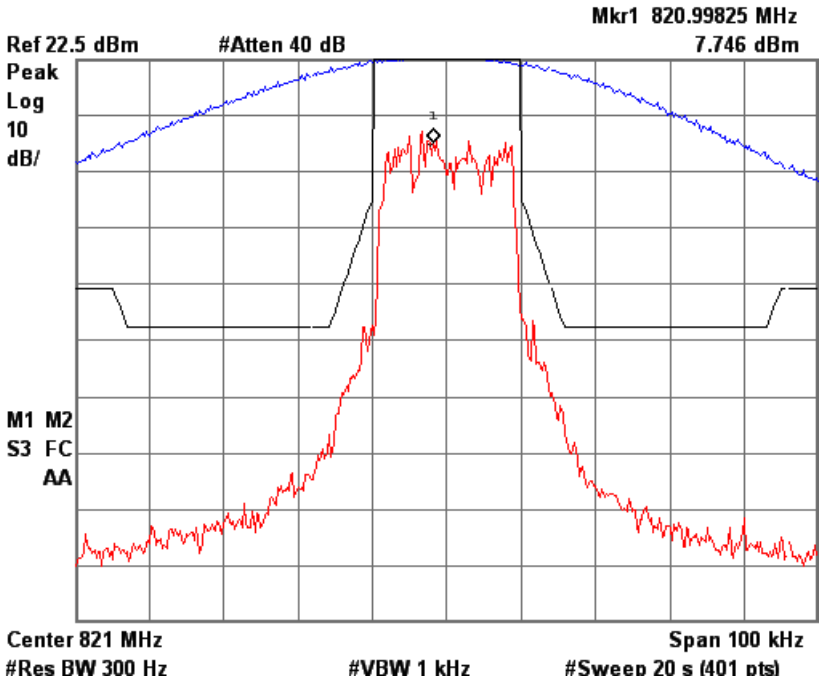


**Figure 6a.2.1-9. iDEN 800 MHz Band, Quad-64QAM, Maximum Power, Emission Mask G**

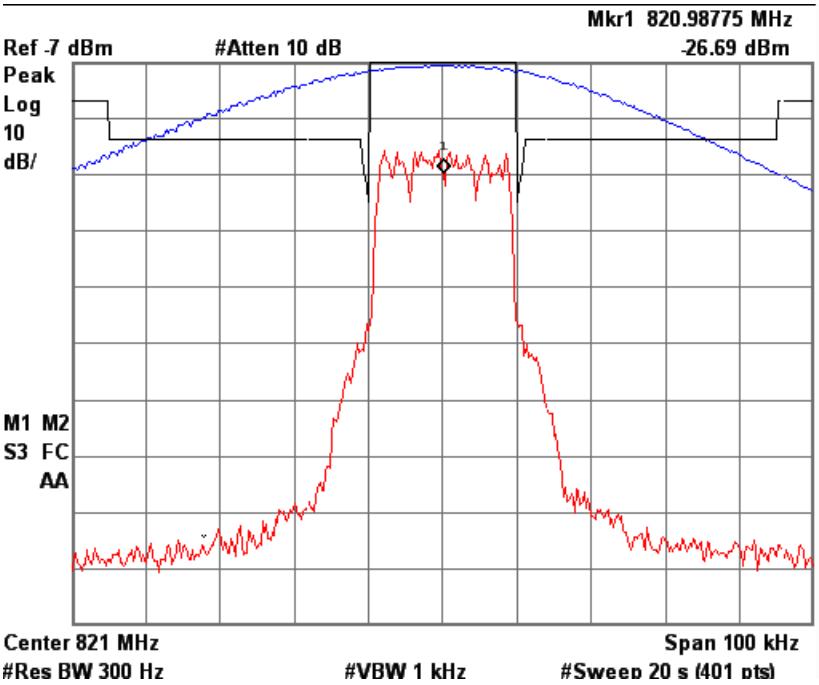


**Figure 6a.2.1-10. iDEN 800 MHz Band, Quad-64QAM, Minimum Power, Emission Mask G**

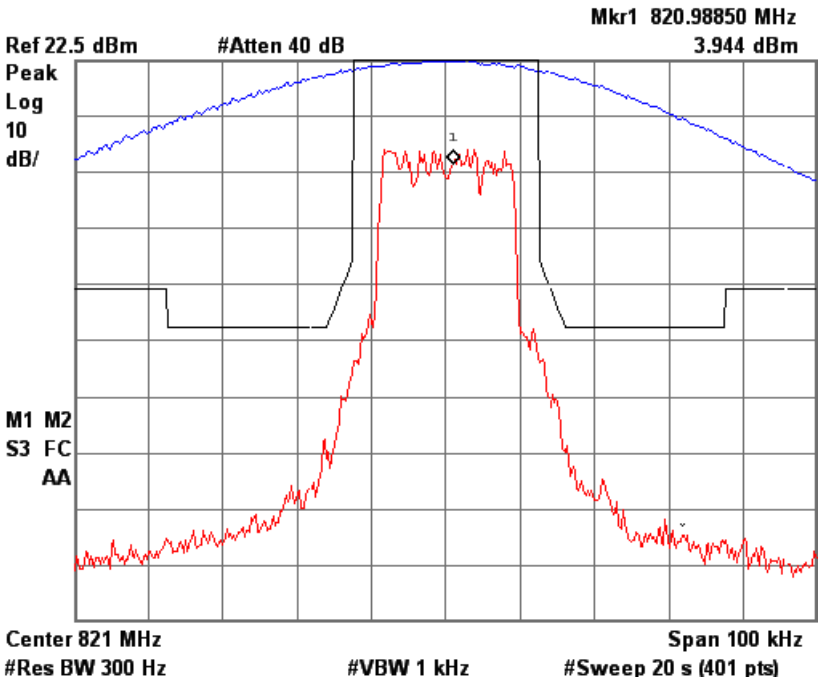


**Figure 6a.2.1-11. iDEN 800 MHz Band, Quad-64QAM, Maximum Power, EA Emission Mask**

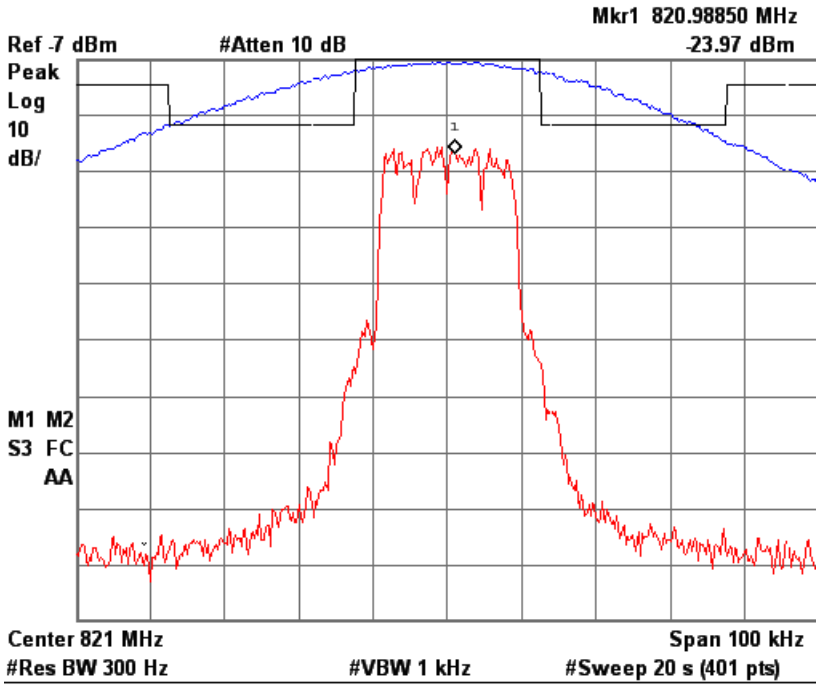


**Figure 6a.2.1-12. iDEN 800 MHz Band, Quad-64QAM, Minimum Power, EA Emission Mask**

### 6a.2.2. Emission Designator 18K3D7W - iDEN 900 MHz Band Measured Data

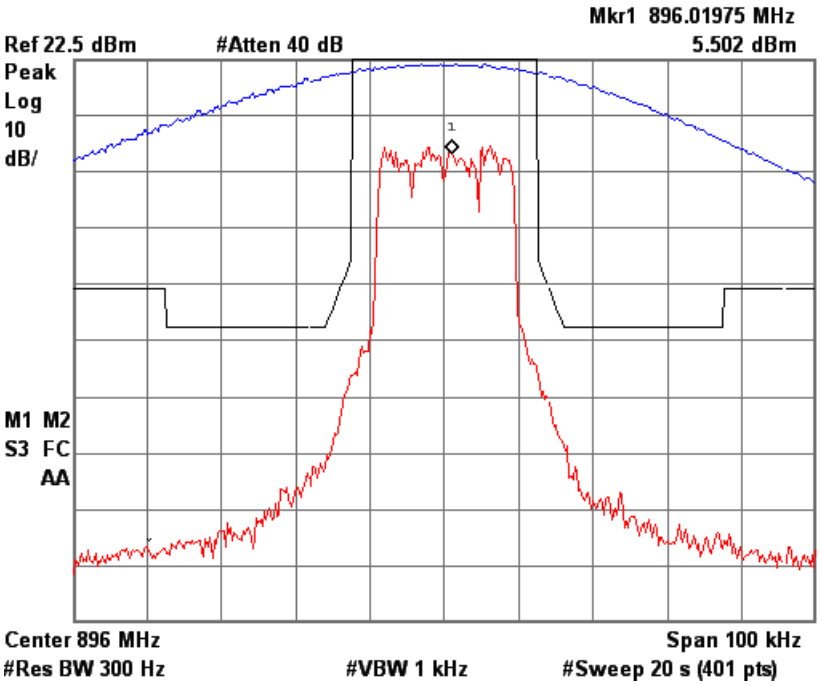


**Figure 6a.2.2-1. iDEN 900 MHz Band, Quad-QPSK, Maximum Power, Emission Mask G**

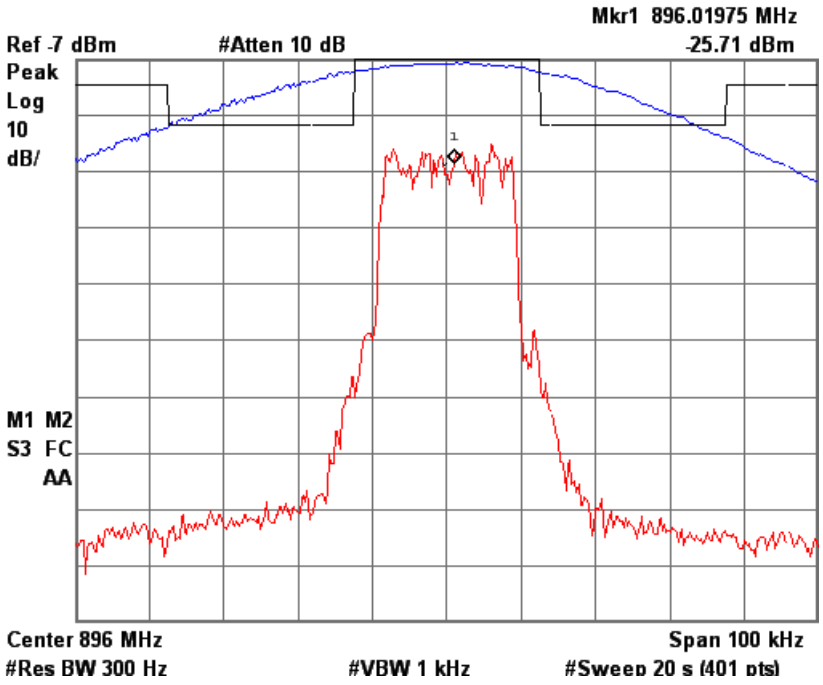


**Figure 6a.2.2-2. iDEN 900 MHz Band, Quad-QPSK, Minimum Power, Emission Mask G**

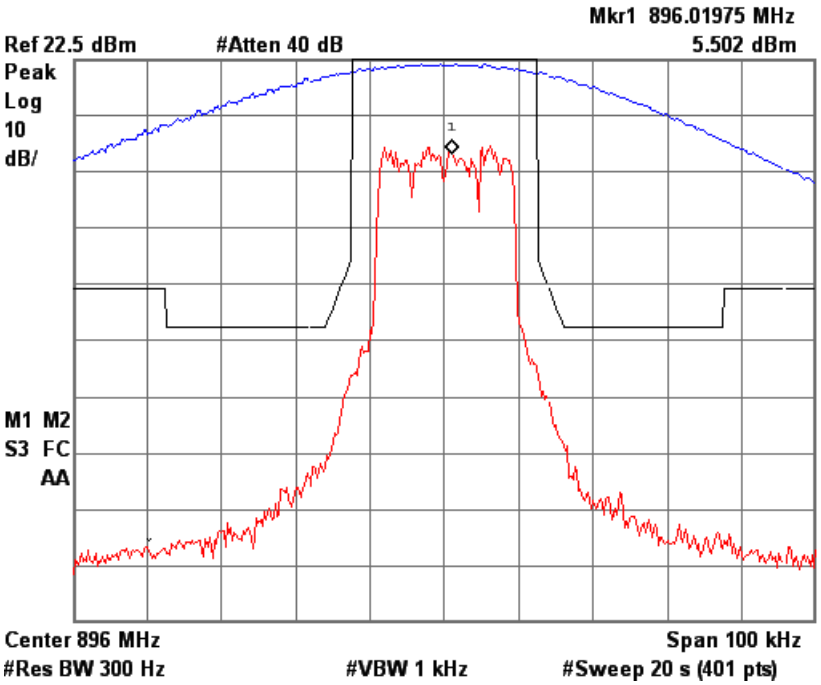


**Figure 6a.2.2-3. iDEN 900 MHz Band, Quad-QPSK, Maximum Power, EA Emission Mask**

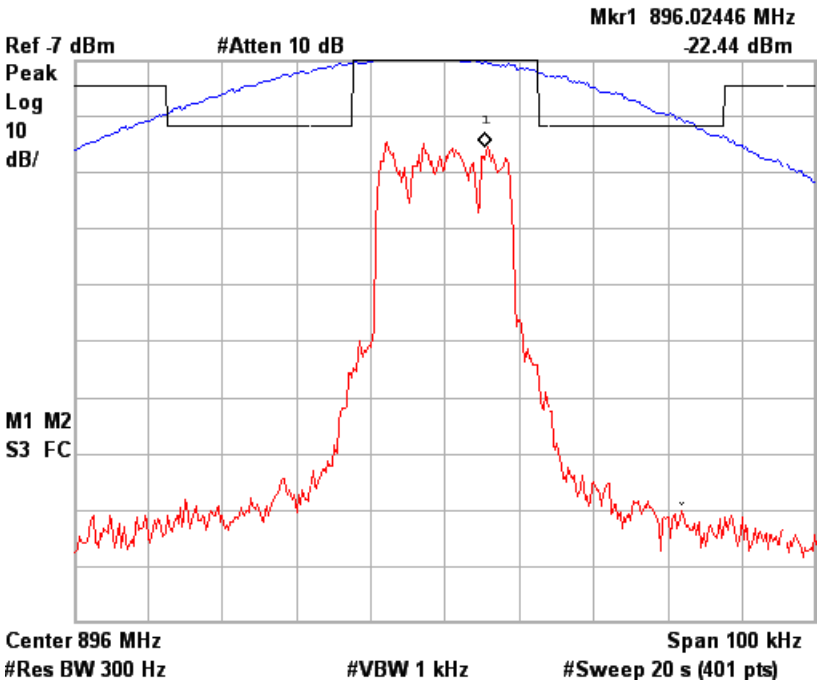


**Figure 6a.2.2-4. iDEN 900 MHz Band, Quad-QPSK, Minimum Power, EA Emission Mask**

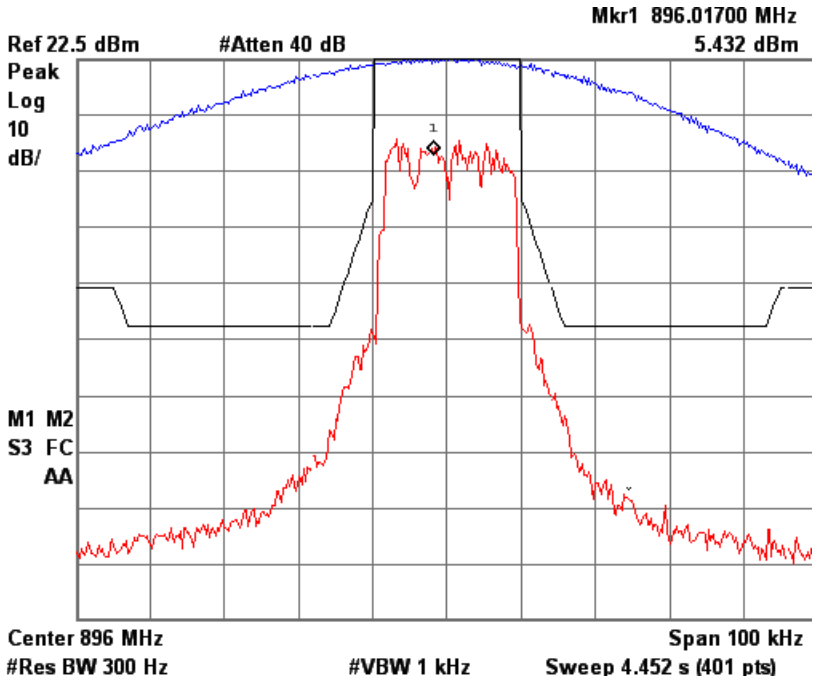


**Figure 6a.2.2-5. iDEN 900 MHz Band, Quad-16QAM, Maximum Power, Emission Mask G**

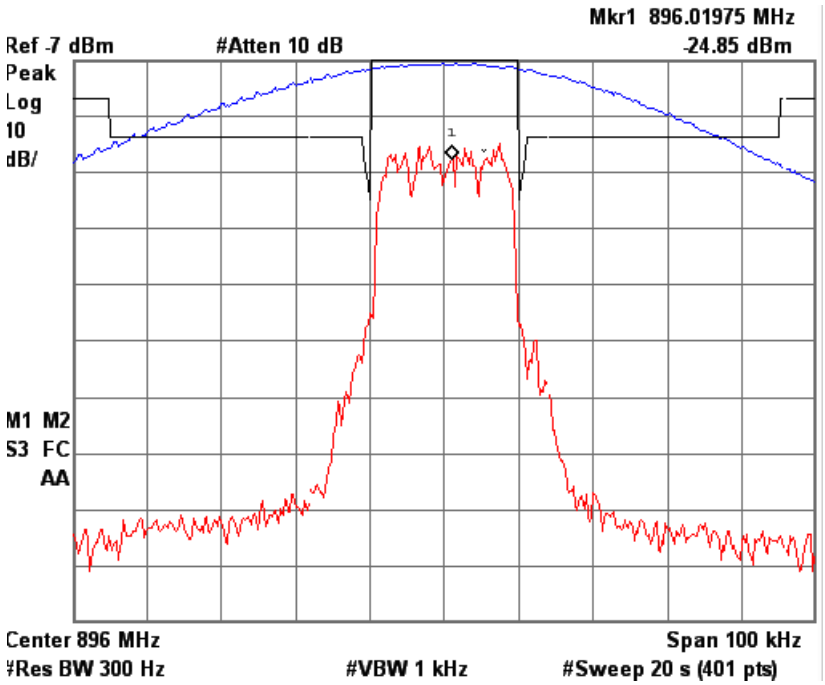


**Figure 6a.2.2-6. iDEN 900 MHz Band, Quad-16QAM, Minimum Power, Emission Mask G**

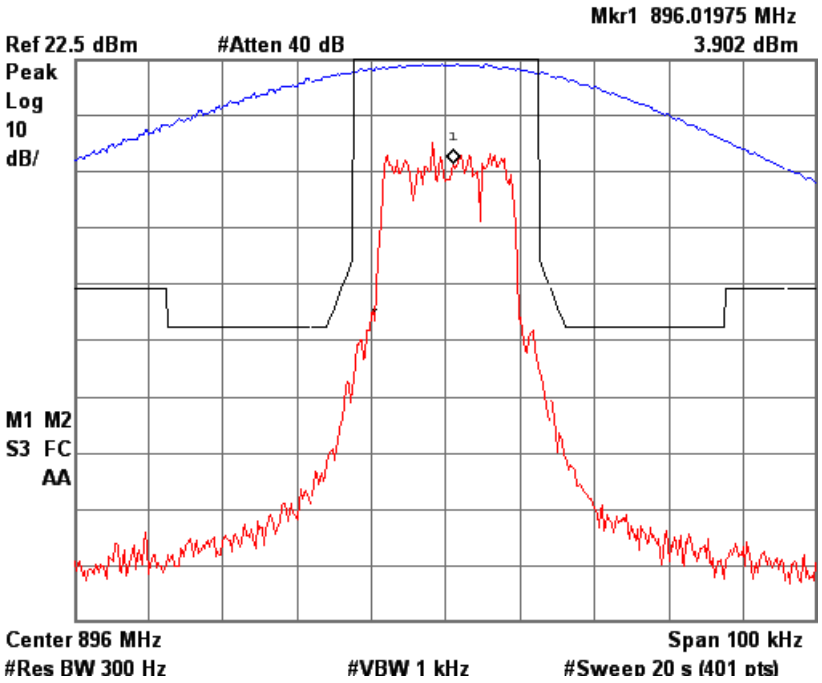


**Figure 6a.2.2-7. iDEN 900 MHz Band, Quad-16QAM, Maximum Power, EA Emission Mask**

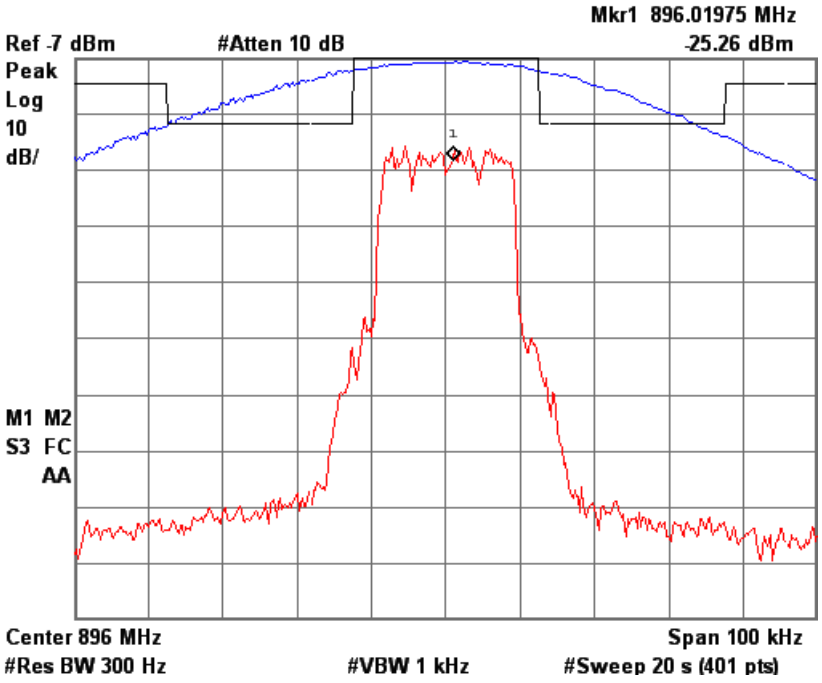


**Figure 6a.2.2-8. iDEN 900 MHz Band, Quad-16QAM, Minimum Power, EA Emission Mask**

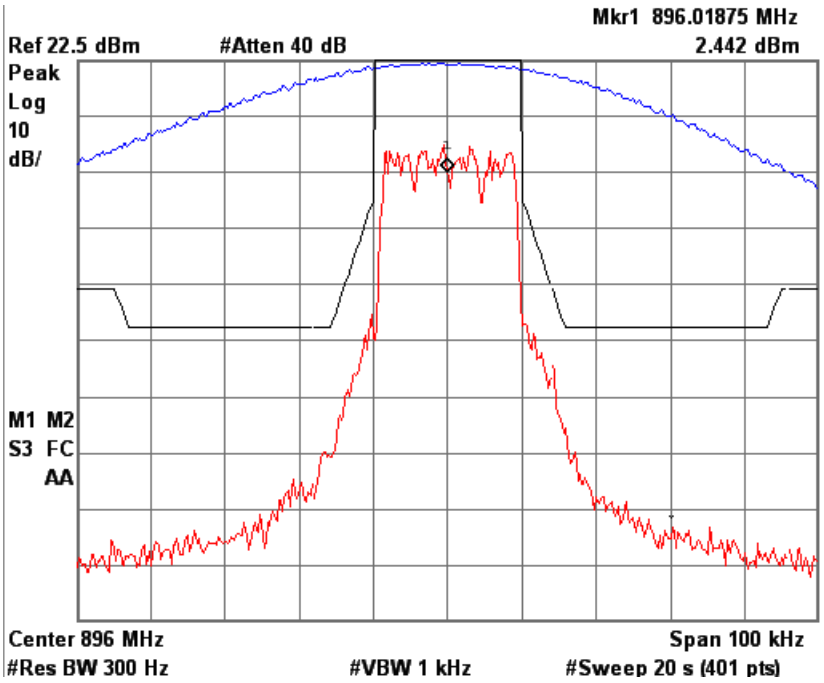


**Figure 6a.2.2-9. iDEN 900 MHz Band, Quad-64QAM, Maximum Power, Emission Mask G**

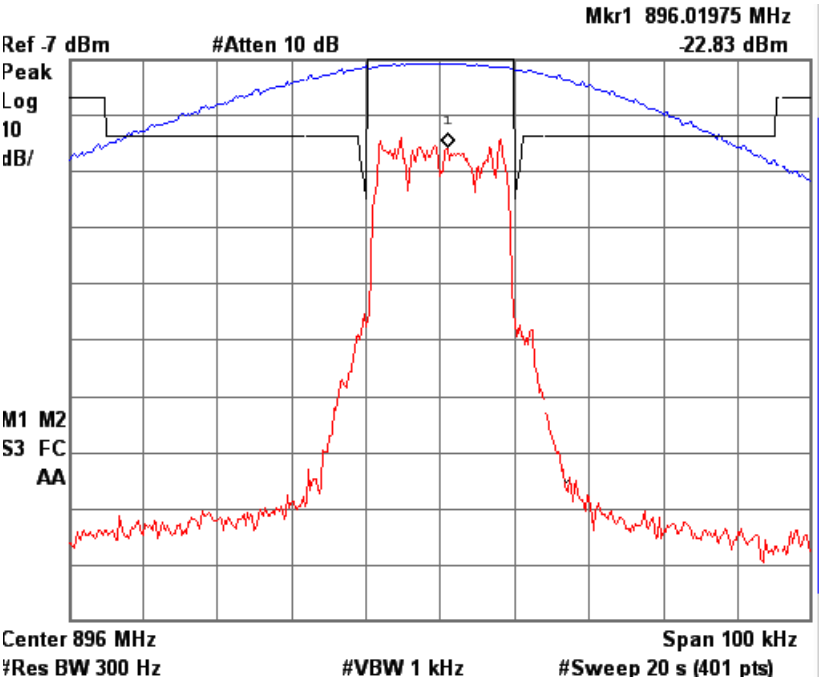


**Figure 6a.2.2-10. iDEN 900 MHz Band, Quad-64QAM, Minimum Power, Emission Mask G**

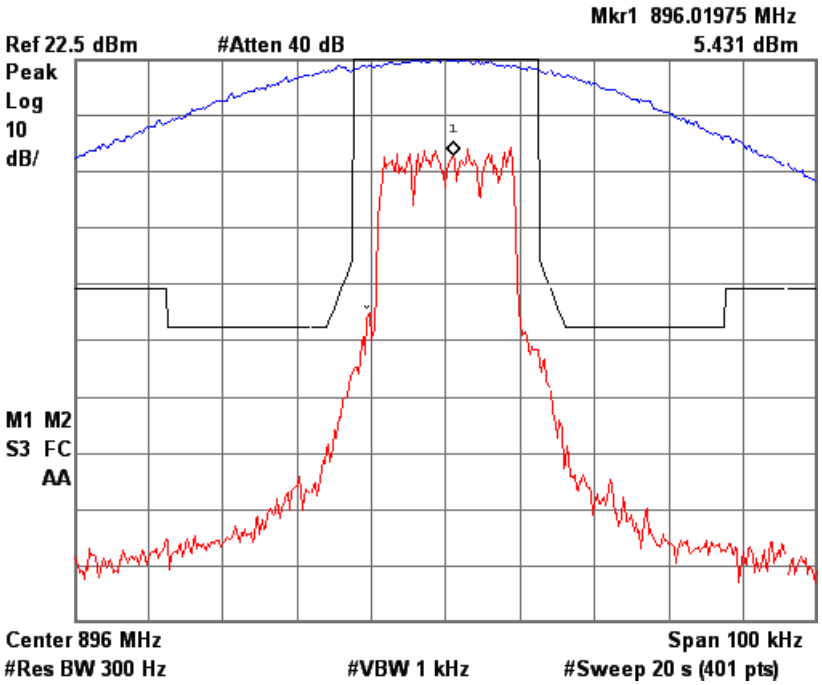


**Figure 6a.2.2-11. iDEN 900 MHz Band, Quad-64QAM, Maximum Power, EA Emission Mask**

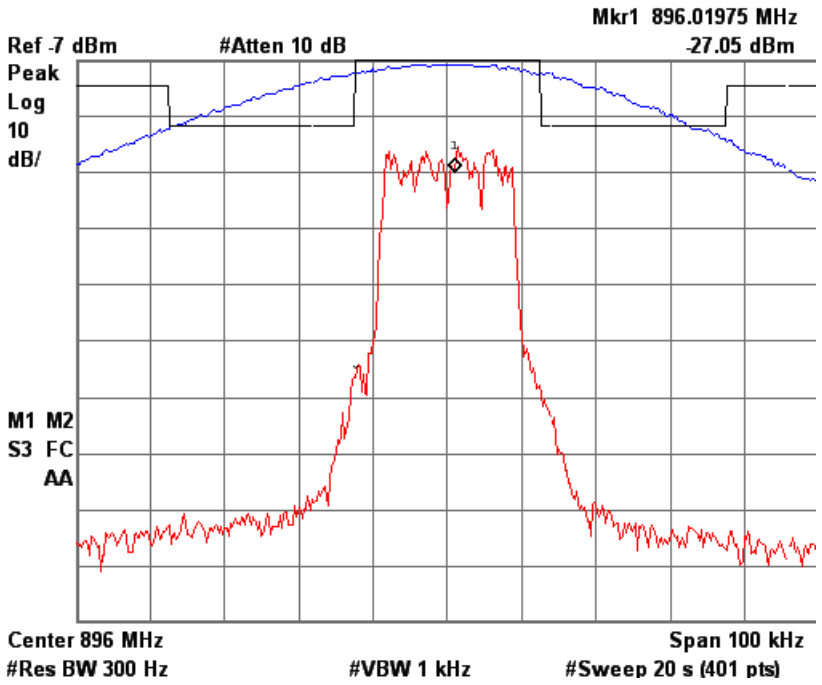


**Figure 6a.2.2-12. iDEN 900 MHz Band, Quad-64QAM, Minimum Power, EA Emission Mask**

# 6b.2. Modulation Characteristics and Necessary Bandwidth -- Pursuant 47 CFR 2.1033(c)(13), §2.1047(d), §2.1049, §2.202, §24.131, and §24.133(a)(1); RSS-Gen Section 3, RSS-134 Section 6.3.

## 6b.2.1 Emission Designator 18K3D7W - NBPCS iDEN Measured data

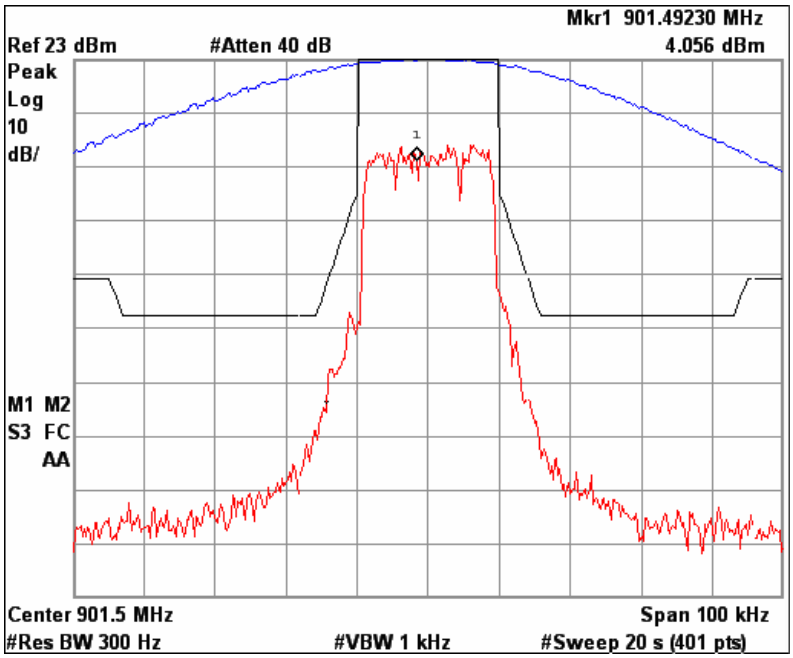


**Figure 6b.2.1-1 iDEN NBPCS Band, Occupied Bandwidth, Quad-QPSK, Maximum Power.**

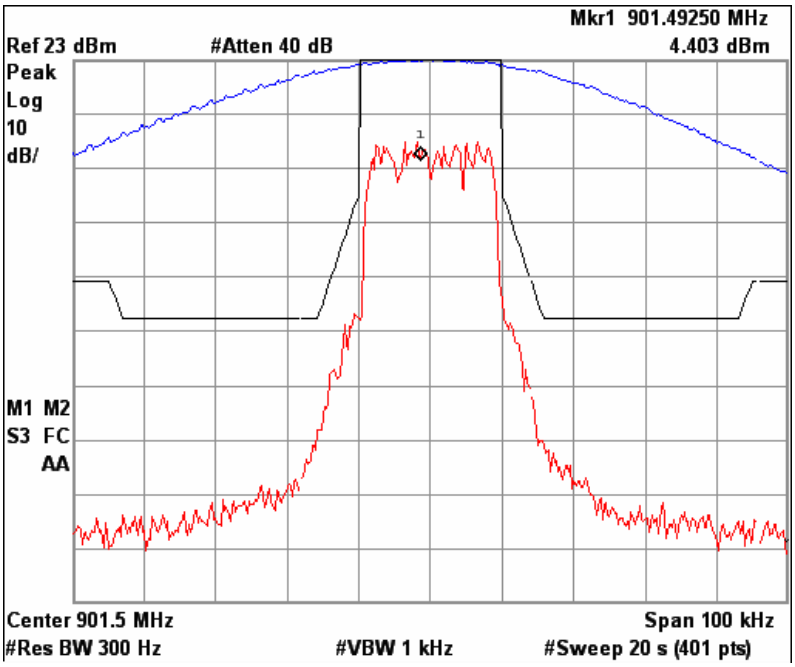


**Figure 6b.2.1-2. iDEN NBPCS Band, Occupied Bandwidth, Quad-16QAM, Maximum Power.**

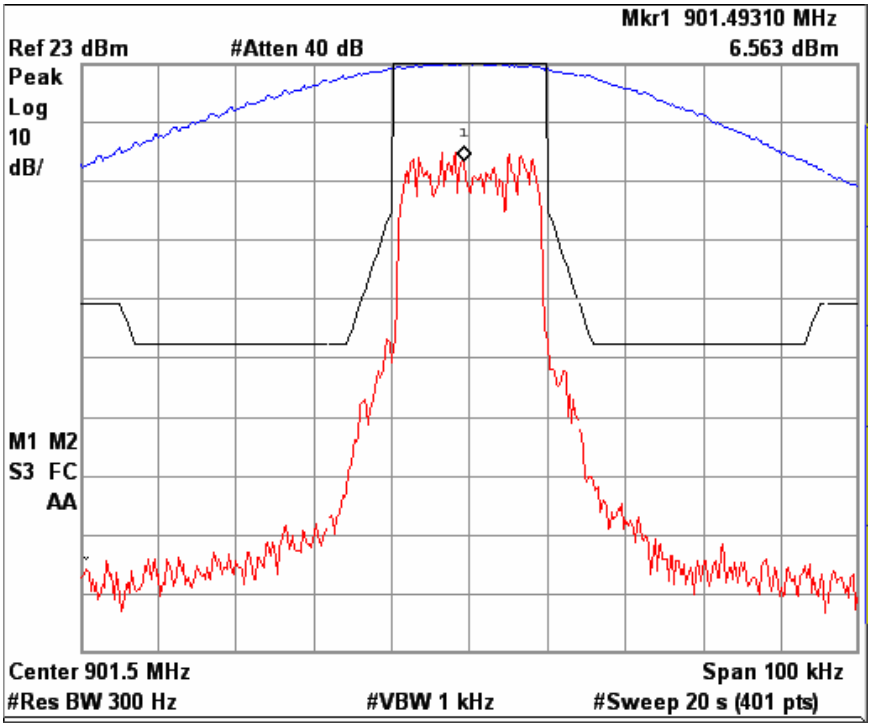


**Figure 6b.2.1-3. iDEN NBPCS Band, Occupied Bandwidth, Quad-64QAM, Maximum Power.**

# 6a.4 Power Line Conducted Spurious Voltage -- Pursuant 47 CFR 15.207; RSS-Gen Section 3.

Conducted voltage limits:

-Per 47 CFR 15.207

This radio product can transmit in 800 and 900 MHz SMR bands while resting in a battery charger that is connected to the AC power line. Each figure contains two measurement traces in addition to the two applicable limit lines (black traces), the higher being applicable to measurements utilizing a quasi-peak detector and the lower being applicable to measurements utilizing an average detector. The upper data trace (light blue) portrays the amplitude of the voltage measured during sweeping with a peak detector while the lower trace (light green) represents the amplitude of the voltage measured using an average detector. These detectors facilitated the measurement process. Measurements with a quasi-peak detector lie between these bounds.

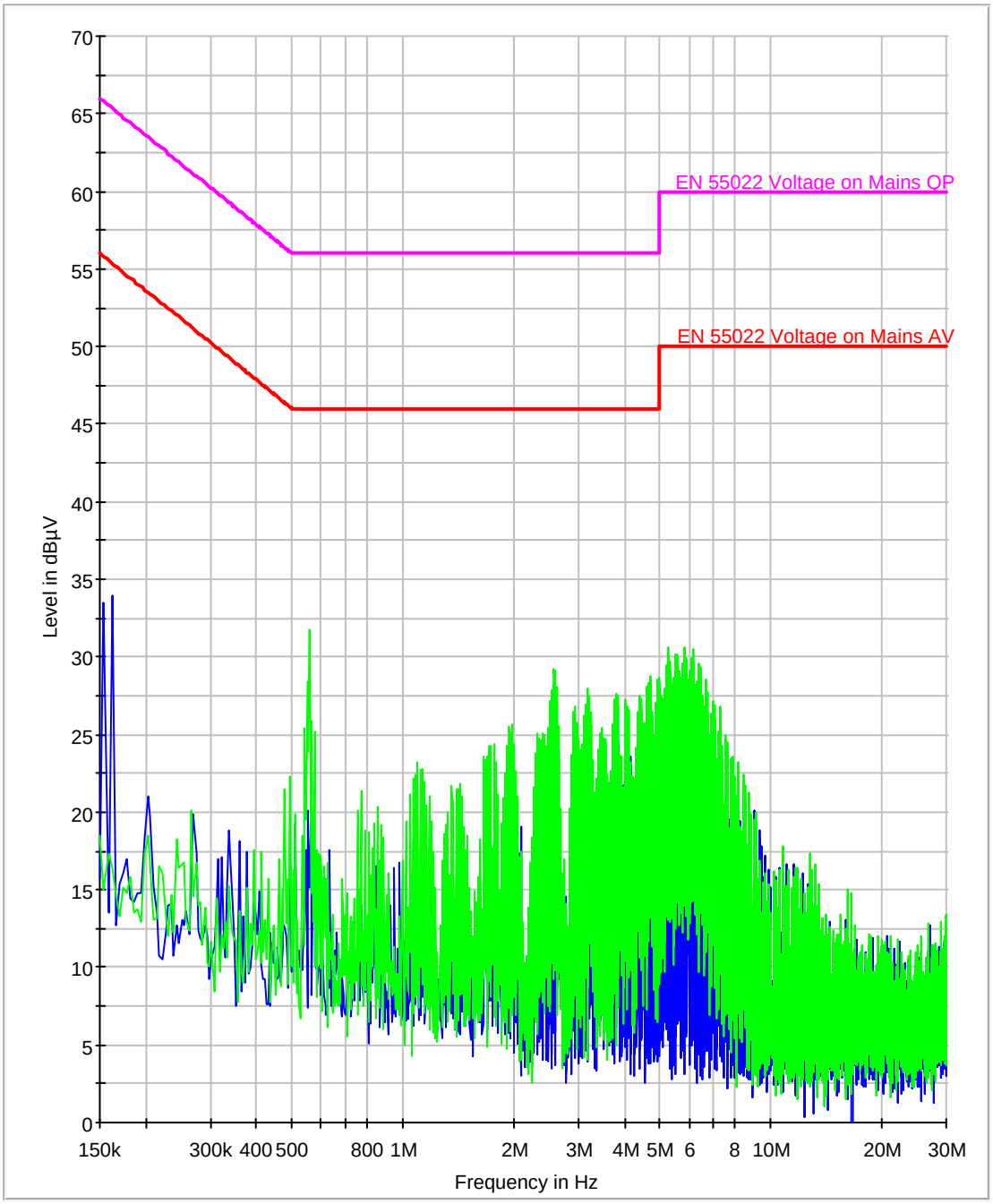


**Figure 6a.4-1: iDEN 800 MHz SMR Band Phase Line and Neutral Line Voltage with a Peak and Average Detector N (Green) L1 (Blue)**

| **Frequency** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **<= 500 kHz** | **QP value** | **QP Limit** | **QP Margin** | **Avr Value** | **Avr Limit** | **Avr Margin** | **Ph** |
| 154000 | 26.10 | 65.89 | 39.79 | 10.00 | 55.89 | 45.89 | L1 |
| 162000 | 25.30 | 65.66 | 40.36 | 9.60 | 55.66 | 46.06 | L1 |
| 202000 | 22.00 | 64.51 | 42.51 | 17.40 | 54.51 | 37.11 | L1 |
| 266000 | 15.90 | 62.67 | 46.77 | 11.00 | 52.67 | 41.67 | L1 |
| 270000 | 18.40 | 62.55 | 44.15 | 16.20 | 52.55 | 36.35 | L1 |
| 322000 | 11.10 | 61.06 | 49.96 | 4.30 | 51.06 | 46.76 | L1 |
| | | | | | | | |
| 154000 | 27.00 | 65.89 | 38.89 | 9.90 | 55.89 | 45.99 | N |
| 162000 | 25.70 | 65.66 | 39.96 | 10.00 | 55.66 | 45.66 | N |
| 202000 | 22.10 | 64.51 | 42.41 | 11.80 | 54.51 | 42.71 | N |
| 266000 | 16.30 | 62.67 | 46.37 | 6.60 | 52.67 | 46.07 | N |
| 270000 | 16.20 | 62.55 | 46.35 | 9.50 | 52.55 | 43.05 | N |
| 322000 | 13.00 | 61.06 | 48.06 | 4.10 | 51.06 | 46.96 | N |

**Table 6a.4-1: Line Voltage Data- Quasi-Peak and Average**

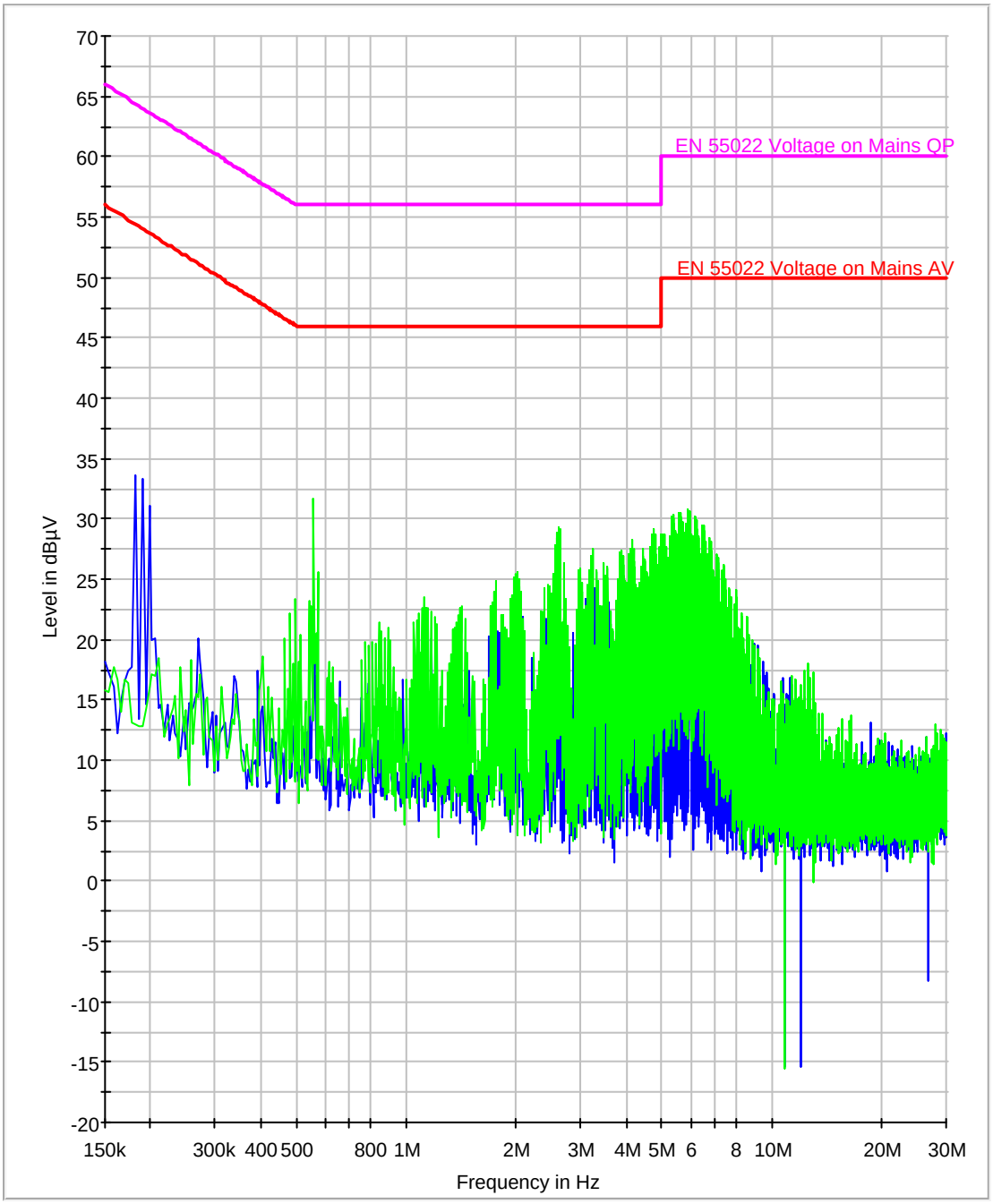


**Figure 6a.4-2: iDEN 900 MHz SMR Band Phase Line and Neutral Line Voltage with a Peak and Average Detector N (Green) L1 (Blue)**

| Frequency | | | | | | | |
|---|---|---|---|---|---|---|---|
| <= 500kHz | QP value | QP Limit | QP Margin | Avr Value | Avr Limit | Avr Margin | Ph |
| 182000 | 25.00 | 65.08 | 40.08 | 8.30 | 55.08 | 46.78 | L1 |
| 190000 | 24.50 | 64.85 | 40.35 | 7.80 | 54.85 | 47.05 | L1 |
| 198000 | 23.70 | 64.62 | 40.92 | 11.50 | 54.62 | 43.12 | L1 |
| 466000 | 9.50 | 56.92 | 47.42 | 2.60 | 46.92 | 44.32 | L1 |
| 482000 | 11.00 | 56.46 | 45.46 | 2.60 | 46.46 | 43.86 | L1 |
| 498000 | 11.20 | 56.00 | 44.80 | 2.50 | 46.00 | 43.50 | L1 |
| | | | | | | | |
| 182000 | 25.10 | 65.08 | 39.98 | 8.10 | 55.08 | 46.98 | N |
| 190000 | 24.20 | 64.85 | 40.65 | 7.50 | 54.85 | 47.35 | N |
| 198000 | 23.60 | 64.62 | 41.02 | 8.70 | 54.62 | 45.92 | N |
| 466000 | 14.90 | 56.92 | 42.02 | 3.70 | 46.92 | 43.22 | N |
| 482000 | 17.50 | 56.46 | 38.96 | 4.40 | 46.46 | 42.06 | N |
| 498000 | 18.00 | 56.00 | 38.00 | 4.30 | 46.00 | 41.70 | N |

**Table 6a.4-2: Line Voltage Data- Quasi-Peak and Average**

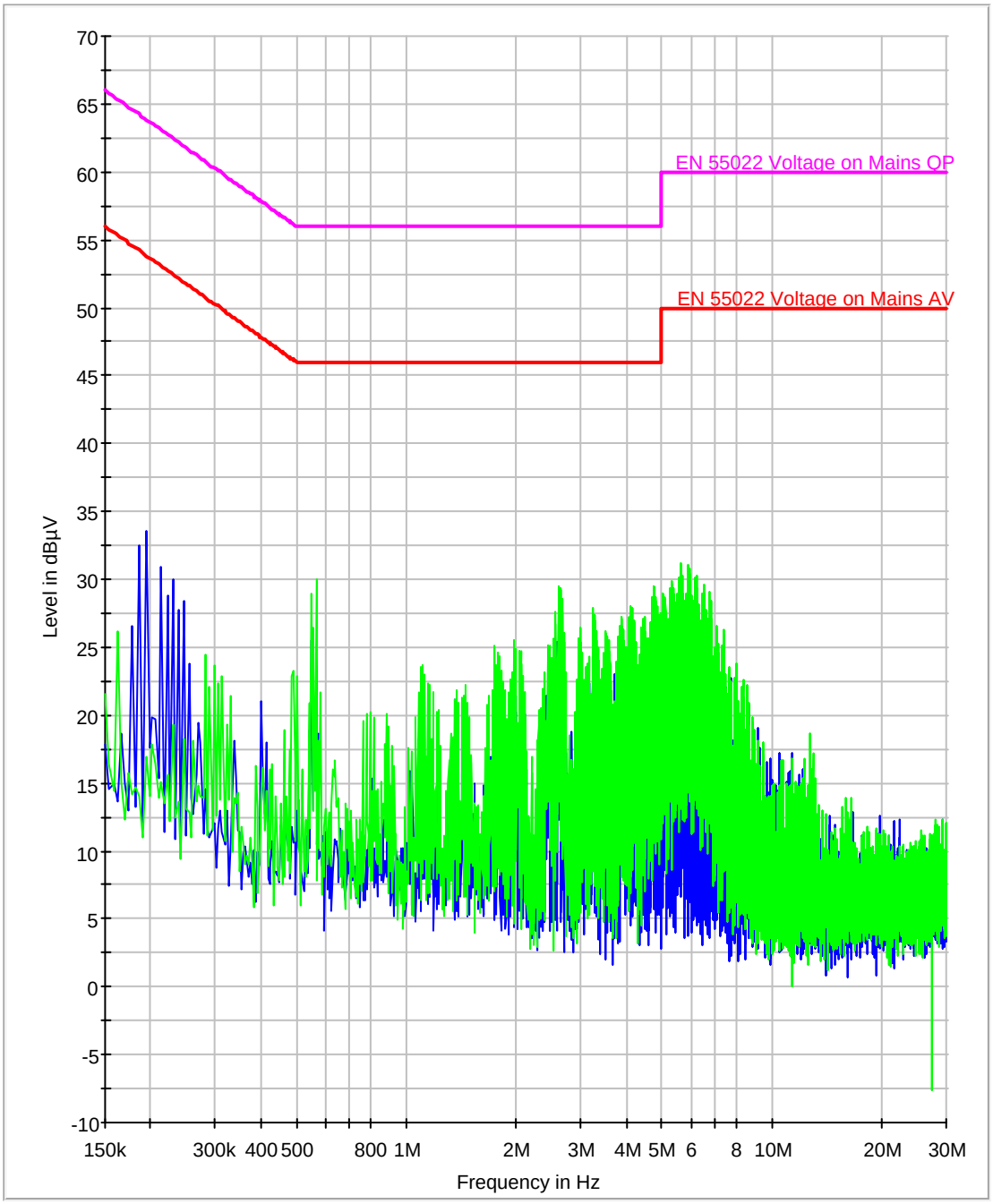


**Figure 6a.4-3: iDEN NBPCS Phase Line and Neutral Line Voltage with a Peak and Average Detector N (Green) L1 (Blue)**

| Frequency | | | | | | | |
|---|---|---|---|---|---|---|---|
| <= 500kHz | QP value | QP Limit | QP Margin | Avg. Value | Avg. Limit | Avg. Margin | Ph |
| 178000 | 25.60 | 65.20 | 39.60 | 8.30 | 55.20 | 46.90 | L1 |
| 186000 | 24.70 | 64.97 | 40.27 | 7.40 | 54.97 | 47.57 | L1 |
| 194000 | 23.80 | 64.74 | 40.94 | 8.20 | 54.74 | 46.54 | L1 |
| 214000 | 22.40 | 64.16 | 41.76 | 7.00 | 54.16 | 47.16 | L1 |
| 230000 | 20.60 | 63.70 | 43.10 | 6.30 | 53.70 | 47.40 | L1 |
| 246000 | 19.20 | 63.24 | 44.04 | 5.50 | 53.24 | 47.74 | L1 |
| | | | | | | | |
| 178000 | 25.10 | 65.20 | 40.10 | 8.40 | 55.20 | 46.80 | N |
| 186000 | 24.70 | 64.97 | 40.27 | 8.20 | 54.97 | 46.77 | N |
| 194000 | 24.20 | 64.74 | 40.54 | 8.20 | 54.74 | 46.54 | N |
| 214000 | 22.20 | 64.16 | 41.96 | 7.20 | 54.16 | 46.96 | N |
| 230000 | 20.80 | 63.70 | 42.90 | 6.50 | 53.70 | 47.20 | N |
| 246000 | 19.70 | 63.24 | 43.54 | 5.90 | 53.24 | 47.34 | N |

**Table 6a.4-3: Line Voltage Data- Quasi-Peak and Average**

# 6a.5 Land Mobile Frequency Stability -- Pursuant to 47 CFR 2.1055(a)(1), §2.1055(d)(2), and §24.135; RSS-Gen Section 3.2, RSS-119 Section 5.3, RSS-134 Section 7.

Frequency stability measurements were made as described in paragraph 7.4. Because of the transmitter's dependence on the stability of the base station oscillator, it is not possible to provide stability data for this transmitter as is commonly supplied for certification per 47 CFR 2.1055 for a radio with a locally stabilized oscillator. The following data was collected in a setup comprising of a base station simulator and it represents the absolute frequency error of the transceiver under test versus the base station frequency reference.

| **Frequency Stability (in ppm) at 813.5125 MHz, Voltage = 4$V_{DC}$** | | |
|---|---|---|
| **TEMP (ºC)** | **Frequency Error (Hz)** | **Error (ppm)** |
| -30 | 34.59 | 0.043 |
| -20 | 67.16 | 0.083 |
| -10 | 18.91 | 0.023 |
| 0 | 65.12 | 0.08 |
| 10 | 81.42 | 0.100 |
| 20 | 11.15 | 0.014 |
| 30 | 79.82 | 0.098 |
| 40 | 136.25 | 0.167 |
| 50 | 84.94 | 0.104 |
| 60 | 47.82 | 0.059 |

**Table 6a.5-1. Transmitter Frequency Stability vs. Temperature in 800 MHz SMR Band.**

| Frequency Stability in PPM at 900.98125 MHz, Voltage = $4V_{DC}$ | | |
|---|---|---|
| **TEMP (ºC)** | **Frequency Error (Hz)** | **Error (ppm)** |
| -30 | 82.67 | 0.092 |
| -20 | 152.36 | 0.170 |
| -10 | 45.28 | 0.051 |
| 0 | 106.32 | 0.119 |
| 10 | 131.19 | 0.146 |
| 20 | 47.59 | 0.053 |
| 30 | 123.93 | 0.138 |
| 40 | 183.56 | 0.205 |
| 50 | 138.49 | 0.155 |
| 60 | 82.38 | 0.092 |

**Table 6a.5-2. Transmitter Frequency Stability vs. Temperature in 900 MHz SMR Band.**

| Frequency Stability in PPM at 900.98125 MHz, Voltage = $4V_{DC}$ | | |
|---|---|---|
| **TEMP (ºC)** | **Frequency Error (Hz)** | **Error (ppm)** |
| -30 | 82.67 | 0.092 |
| -20 | 152.36 | 0.170 |
| -10 | 45.28 | 0.051 |
| 0 | 106.32 | 0.119 |
| 10 | 131.19 | 0.146 |
| 20 | 47.59 | 0.053 |
| 30 | 123.93 | 0.138 |
| 40 | 183.56 | 0.205 |
| 50 | 138.49 | 0.155 |
| 60 | 82.38 | 0.092 |

**Table 6a.5-3. Transmitter Frequency Stability vs. Temperature in 900 MHz NBPCS Band.**

| Frequency Stability in PPM at 813.5125 MHz, Temperature = 25°C | | |
|---|---|---|
| **Power Supply Output Voltage** | **Frequency Error in Hz** | **PPM** |
| 3.55 | 43.68 | 0.054 |
| 3.6 | 39.51 | 0.049 |
| 3.7 | 67.52 | 0.083 |
| 3.8 | 70.28 | 0.086 |
| 3.9 | 68.49 | 0.084 |
| 4.0 | 55.85 | 0.069 |
| 4.1 | 58.75 | 0.072 |
| 4.2 | 39.25 | 0.048 |

**Table 6a.5-4. Transmitter Frequency Stability vs. Voltage in 800 MHz SMR Band.**

| Frequency Stability in PPM at 896.01875 MHz, Temperature = 25°C | | |
|---|---|---|
| **Power Supply Output Voltage** | **Frequency Error in Hz** | **PPM** |
| 3.55 | 87.16 | 0.107 |
| 3.6 | 76.91 | 0.095 |
| 3.7 | 121.35 | 0.135 |
| 3.8 | 134.51 | 0.150 |
| 3.9 | 119.05 | 0.133 |
| 4.0 | 125.81 | 0.140 |
| 4.1 | 107.21 | 0.120 |
| 4.2 | 85.94 | 0.096 |

**Table 6a.5-5. Transmitter Frequency Stability vs. Voltage in 900 MHz SMR Band.**

| Frequency Stability in PPM at 900.98125 MHz, Temperature = 25°C | | |
|---|---|---|
| **Power Supply Output Voltage** | **Frequency Error in Hz** | **PPM** |
| 3.55 | 87.16 | 0.107 |
| 3.6 | 76.91 | 0.095 |
| 3.7 | 121.35 | 0.135 |
| 3.8 | 134.51 | 0.150 |
| 3.9 | 119.05 | 0.133 |
| 4.0 | 125.81 | 0.140 |
| 4.1 | 107.21 | 0.120 |
| 4.2 | 85.94 | 0.096 |

**Table 6a.5-6. Transmitter Frequency Stability vs. Voltage in 900 MHz NBPCS Band.**

# 6a.6 Effective Radiated Power (ERP) -- Pursuant 47 CFR 2.1046 and §24.132(b); RSS-Gen Section 3.2, RSS-119 Section 5.4, RSS-134 Section 6.2.

The ERP characteristic was measured while a radio was set to transmit a test mode signal at the maximum rated output power (+/- 5%) and was vertically mounted on a non-conducting platform/turntable in a spherical RF Anechoic Chamber. The power at the receive antenna was recorded on a power meter with the unit rotating about the z-axis. The azimuth of receiving antenna is rotated 180 degrees while the UUT is rotating producing a spiral antenna measurement. For this ERP test, the phi cuts were taken in 15 degree increments or slices and the theta spins used about 200 measurements per rotation. ERP data is extracted from the phi= 90 degree cut. The power recorded from the meter is then corrected to compensate for path loss, cable losses, and amplifier and antenna gains at the given frequencies resulting in absolute radiated power.

The following calculations show how the reported scaled max ERP was determined.

**For 800 MHz SMR band operation,**

$$Measured\ MaxERP, dBm = 10 * \log(measured\ output\ power, mW) + measured\ \ antenna\ gain, dBd$$

= 25.46 dBm

The resulting max ERP was converted to mW:

$$MeasuredMaxERP, mW = 10^{\left(\frac{Measured\ MaxERP, dBm}{10}\right)}$$

= 351.64 mW

Since the measured max ERP was not determined at the production maximum output power, a simple scaling is performed to 640 mW:

$$Scaled\ MaxERP, mW = Measured\ MaxERP, mW * \left(\frac{640mW}{measured\ output\ power, mW}\right)$$

= 384.05 mW

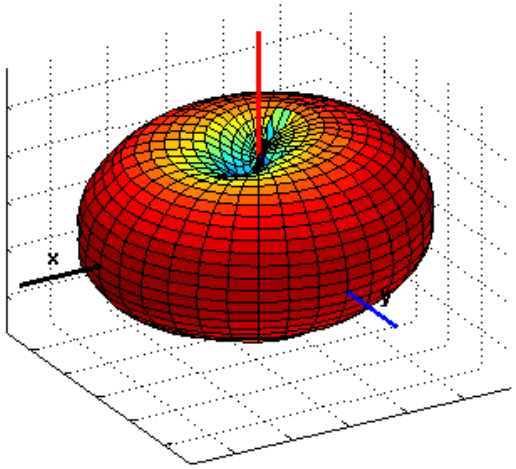

Figure 6a.6-1 Antenna pattern in the 800 MHz SMR frequency band (Flip Open)

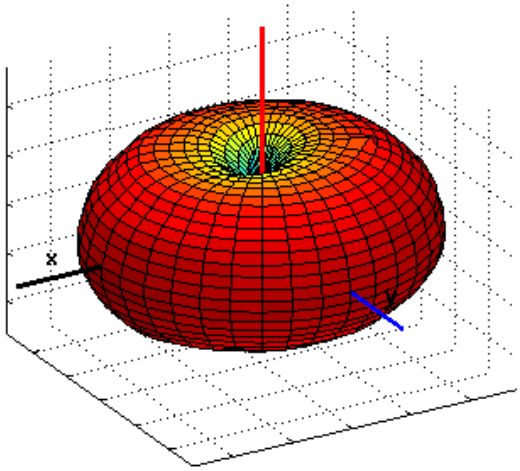

Figure 6a.6-2 Antenna pattern in the 800 MHz SMR frequency band (Flip Closed).

**For 900 MHz SMR band operation,**

$$Measured\ MaxERP, dBm = 10 * \log(measured\ output\ power, mW) + measured\ \ antenna\ gain, dBd$$

$$= 25.25 \text{ dBm}$$

The resulting max ERP was converted to mW:

$$MeasuredMaxERP, mW = 10^{\left(\frac{Measured\ MaxERP, dBm}{10}\right)}$$

$$= 334.66 \text{ mW}$$

Since the measured ERP was not determined at the production maximum output power, a simple scaling is performed to 640 mW:

$$Scaled\ MaxERP, mW = Measured\ MaxERP, mW * \left(\frac{640 mW}{measured\ output\ power, mW}\right)$$

$$= 381.8 \text{ mW}$$

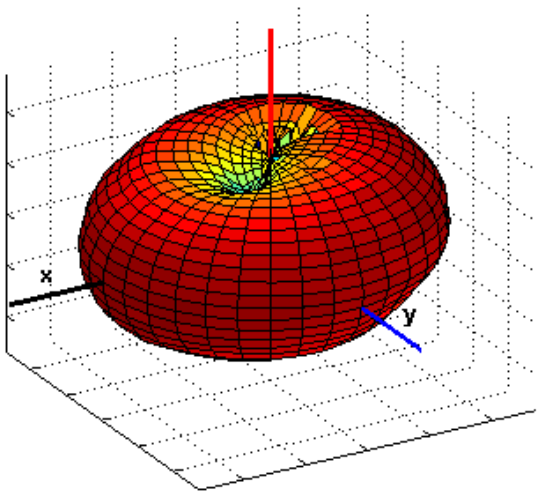


Figure 6a.6-3 Antenna pattern in the 900 MHz SMR frequency band (Flip Open).

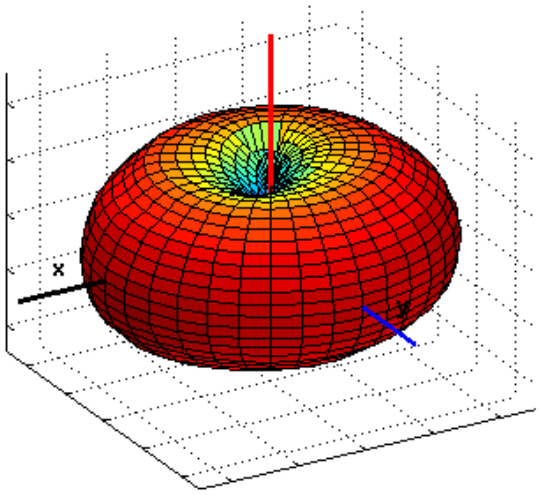


Figure 6a.6-4 Antenna pattern in the 900 MHz SMR frequency band (Flip Closed).

**For 900 MHz NBPCS band operation**,

$$Measured\ MaxERP, dBm = 10 * \log(measured\ output\ power, mW) + measured\ antenna\ gain, dBd$$

= 25.25 dBm

The resulting max ERP was converted to mW:

$$MeasuredMaxERP, mW = 10^{\left(\frac{Measured\ MaxERP, dBm}{10}\right)}$$

= 334.66 mW

Since the measured ERP was not determined at the production maximum output power, a simple scaling is performed to 640 mW:

$$Scaled\ MaxERP, mW = Measured\ MaxERP, mW * \left(\frac{640mW}{measured\ output\ power, mW}\right)$$

= 381.8 *mW*

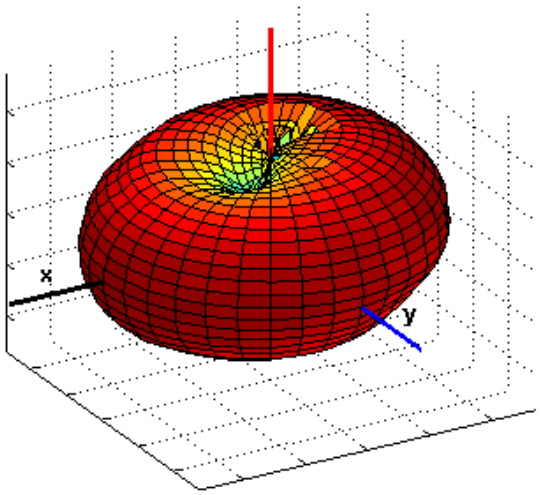


Figure 6a.6-5 Antenna pattern in the NBPCS frequency band (Flip Open).

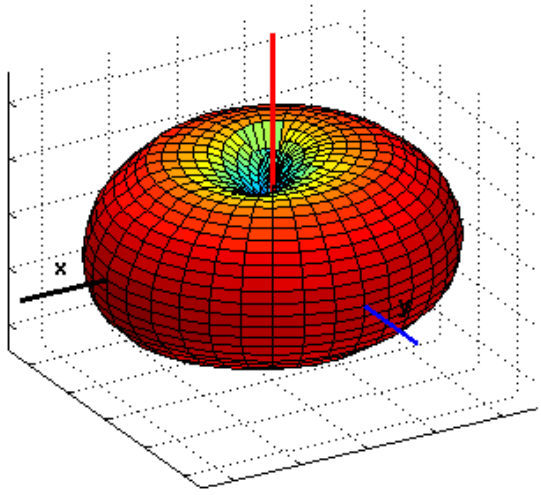


Figure 6a.6-6 Antenna pattern in the NBPCS frequency band (Flip Closed).