Mobile Devices business
iDEN Mobile Devices Operations

RF Test Report

FCC Rule Parts: 15C (MOTOtalk)
Industry Canada: RSS-Gen, RSS-210

Product Name: i465

FCC ID: IHDT56KB1

IC ID: 109O-KB1

Date: February 11, 2009

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[1] Submitted as a separate exhibit, potentially covered under a Temporary Confidentiality request.

Test Report Details

Tests Performed by:	Motorola EMC Laboratory Plantation, Florida 8000 W. Sunrise Blvd Plantation, Florida 33322 Phone: FAX:
	FCC Registration Number: **91932** Industry Canada Number: **IC109U-1**
Product Type:	Cellular Phone
Signaling Capabilities:	MOTOtalk 900 MHz ISM
FCC ID:	IHDT56KB1
IC ID:	109O-KB1

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 15 Subpart C – Radio Frequency Devices.
X	RSS-210 – Low-power License-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment.

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

Exhibit 6b: Part 15 MOTOtalk ISM Band Transmitter Measured Data

6b.1 MOTOtalk ISM Band Transmitter Output Power -- Pursuant 47 CFR 2.1033(b)(6), §2.1041, §2.1046(a), §15.247(b)(2); RSS-Gen Section 3, RSS-210 Section A8.4.

Criterion: The maximum peak conducted output power of the intentional radiator shall not exceed the following: For frequency hopping systems operating in the 902–928 MHz band: 1 watt for systems employing at least 50 hopping channels.

The ISM transmitter operating in the 902-928 MHz band is a frequency hopped, fixed output power type. Output power (as defined in 47 CFR 15.247) is controlled as described in Exhibit 12.

Maximum peak output power rating: 1000 milliwatts (30 dBm), peak power. The modulation scheme employed can cause peak fluctuations in output power of up to 0.5 dB from maximum pulse average power, which is 890 mW (29.5 dBm).

Nominal output power is 743 mW (28.71 dBm), pulse average power. This level was established to maintain compliance with maximum output power rating. It includes consideration of variation of peak to average power fluctuations in the output RF power, variation in output power due to changes in voltage and operating temperature, and manufacturing tolerances in establishing nominal output power.

Power Setting	**maximum**
DC Voltage (Volts)	4
DC Current (A)	1.44
Output Power (mW)	890

Table 6b.1 Characteristics for MOTOtalk 902-928 MHz ISM band

Exhibit 6b.2: MOTOtalk Measured Data– Pursuant 47 CFR 2.1041; RSS-Gen Section 3.

6b.2.1 MOTOtalk ISM Band Carrier Separation between Hop Sets – Pursuant 47 CFR 15.247(a)(1); RSS-210 Section A8.1.

The separation between frequencies is measured to be 500 kHz.

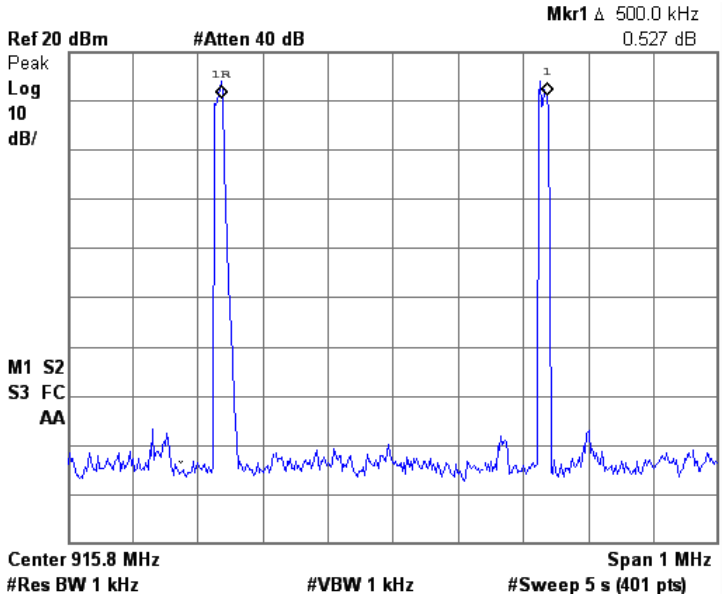


Figure 6b.2.1.1. Plot of MOTOtalk ISM Band adjacent channel separation within a hop set.

6b.2.2 MOTOtalk ISM Band Hopping Bandwidth between Hop Sets –Pursuant 47 CFR 15.247 (a)(1)(i); RSS-210 Section A8.1.

The Figure below shows the plot of the 8FSK, traffic channel MOTOtalk ISM Band spectrum with its bandwidth of 27.25 kHz at 902.525 MHz. The plot shows at least 20 dBc with the 50 kHz offset from the carrier.

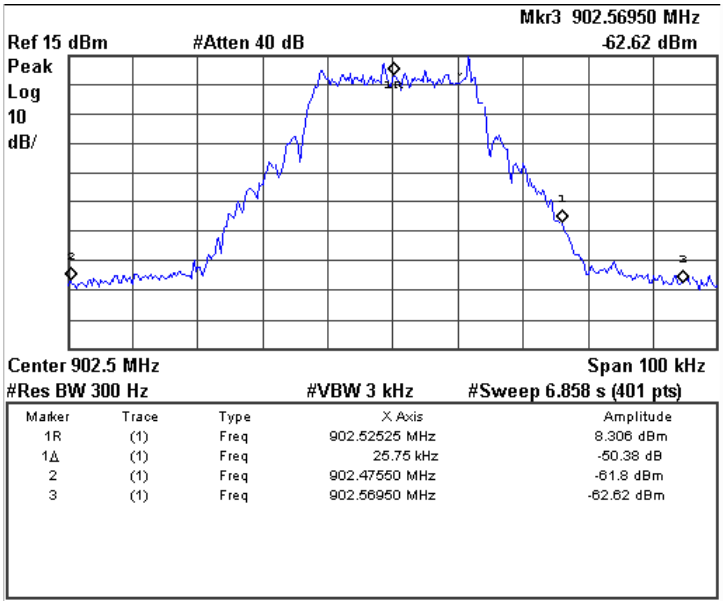


Figure 6b.2.2.1 Spectrum analyzer plot of MOTOtalk ISM Band 8-FSK traffic channel signal's 99% bandwidth at center frequency 902.525 MHz, with hopping function disabled.

The adjacent hop set channel separation was measured between hop set 1 at 902.525 MHz and hop set 2 at 902.575 MHz, which is 50 kHz.

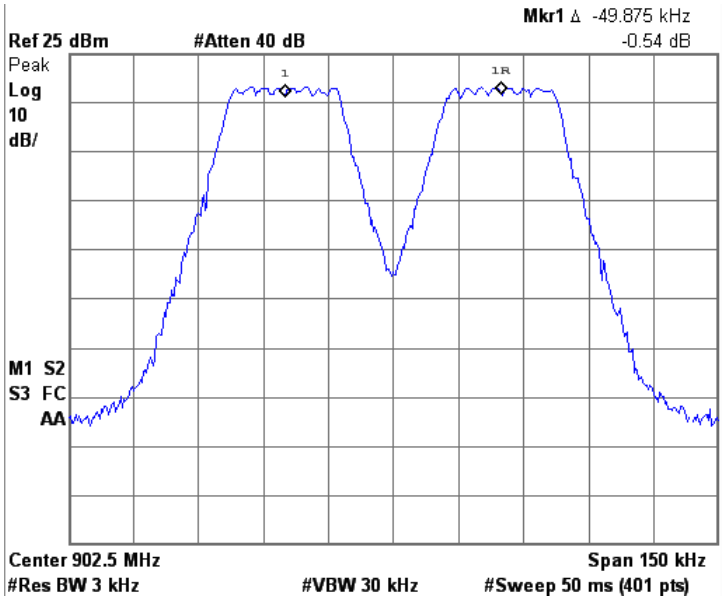


Figure 6b.2.2.2. Adjacent hop set separation with spectrum analyzer center frequency at 902.55 MHz.

Figure 6b.2.2.3 shows that, in any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator is at least 20 dB (measured value here is 68.09 dB) below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

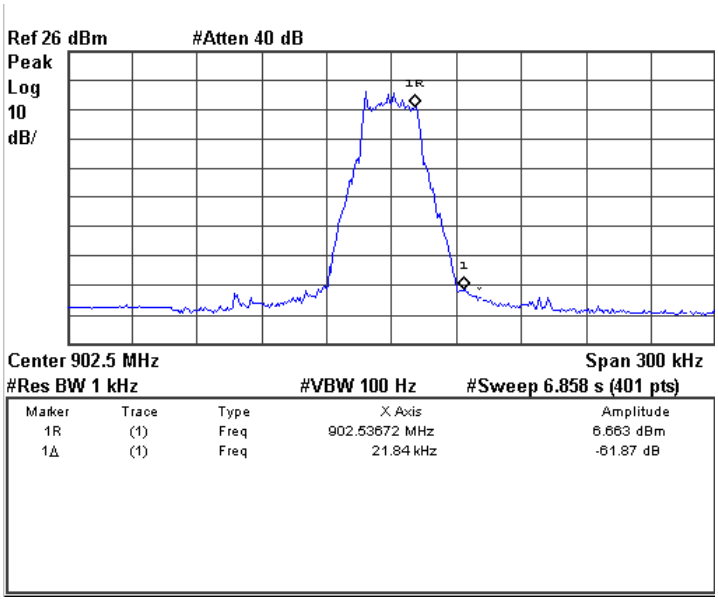


Figure 6b.2.2.3 MOTOtalk ISM band occupied bandwidth with frequency span of 300 kHz with hopping function disabled at center frequency 902.525 MHz.

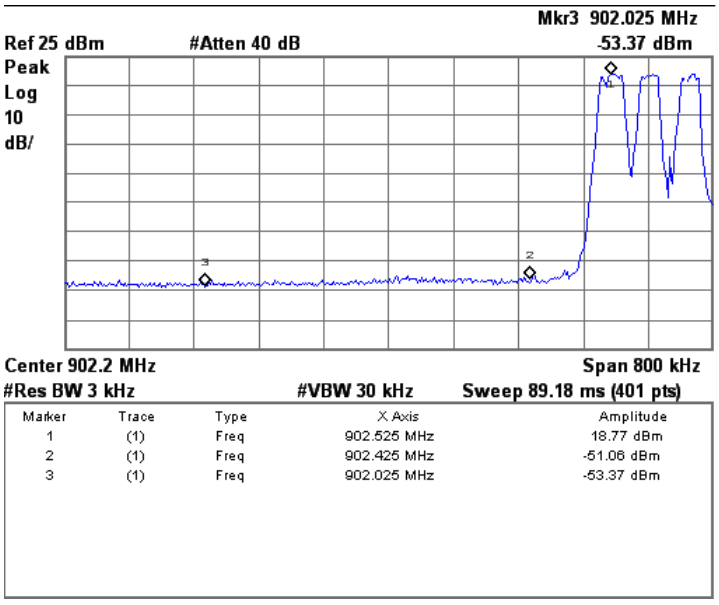


Figure 6b.2.2.4. Out-of-band transmitter spurious emissions low band edge, with hopping function enabled.

The Figure below shows the plot of the 8FSK, traffic channel MOTOtalk ISM Band spectrum with its bandwidth of 26.25 kHz at 927.475 MHz. The plot shows spurious emissions attenuation of at least 20 dBc, with the 50 kHz offset from the carrier.

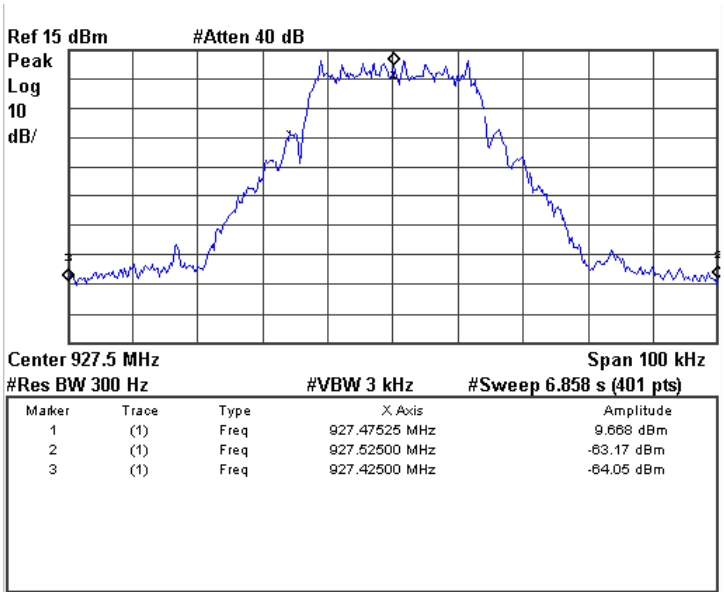


Figure 6b.2.2.5 Spectrum analyzer plot of MOTOtalk ISM Band 8-FSK traffic channel signal's 99% bandwidth with hopping function disabled, at center frequency 927.475 MHz.

The adjacent hop set channel separation was measured between hopset9 @ 927.475 MHz and hopset10 @ 927.525 MHz which is 49.875 kHz.

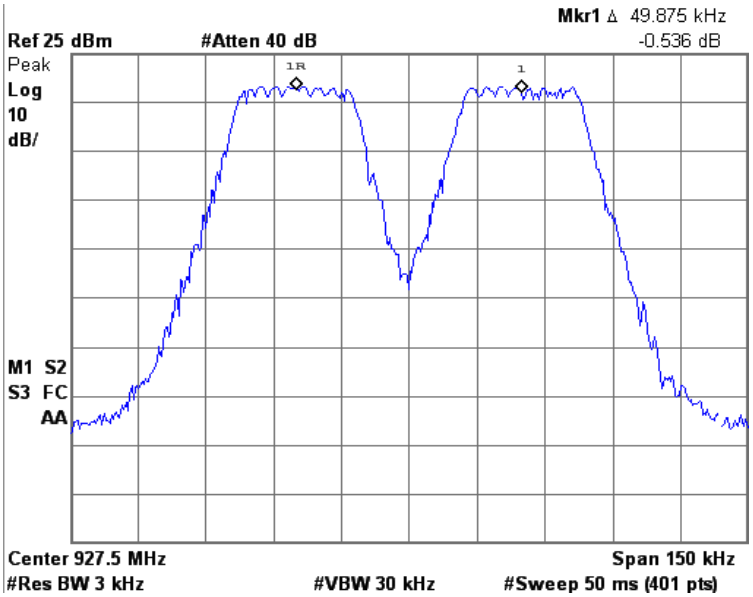


Figure 6b.2.2.6. Adjacent hop set separation with spectrum analyzer center frequency 927.5 MHz.

Figure 6b.2.2.7 shows that, in any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator is at least 20 dB (measured value here is 71.97 dB) below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

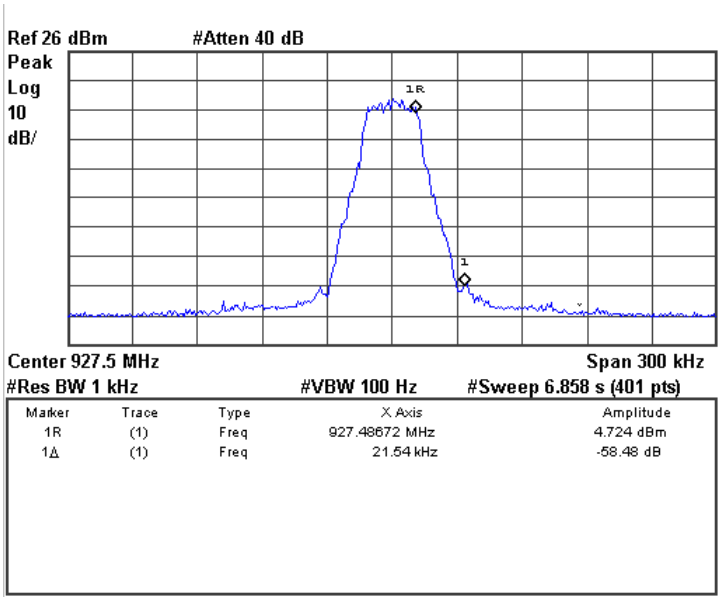


Figure 6b.2.2.7 MOTOtalk ISM band occupied bandwidth with frequency span of 300 kHz with hopping function disabled, at center frequency 927.475.

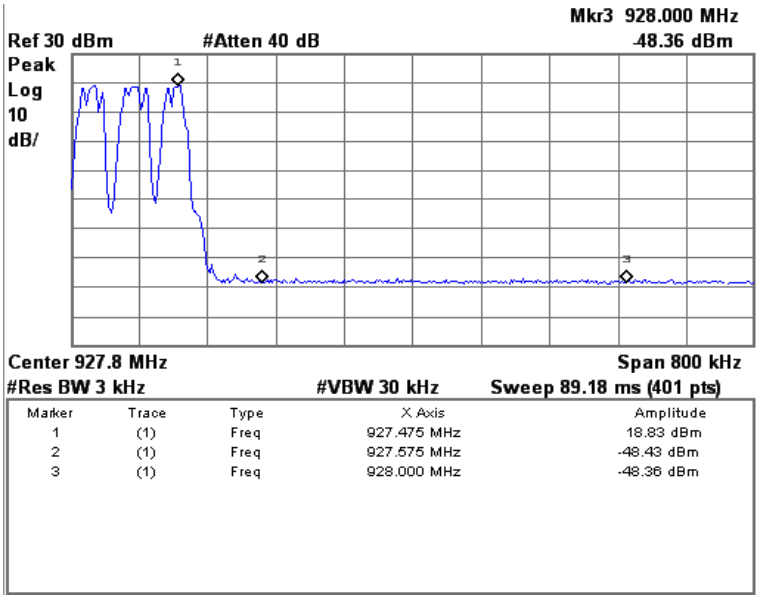


Figure 6b.2.2.8. Out-of-band transmitter spurious emissions high band edge, with hopping function enabled.

6b.2.3 MOTOtalk ISM Band Receiver Bandwidth – Pursuant 47 CFR 15.247(a)(1); RSS-210 Section A8.1.

The receiver bandwidth is limited by a 2-pole analog filter and digital processing that includes a 5th order SIN filter, IIR high-pass programmable bandwidth filter, and a 15th order programmable selectivity filter. The composite 3 dB bandwidth is 28 kHz.

6b.2.4 MOTOtalk ISM Band Number of Hopping Frequencies – Pursuant 47 CFR 15.247(a)(1)(i); RSS-210 Section A8.1.

The MOTOtalk ISM Band transmitter uses 50 frequencies within each selected hop set.

Hop Set	1st Frequency (MHz)	Progression (MHz)	Last (50th) Frequency (MHz)
1	902.525	903.025, 903.525, 904.025...	927.025
2	902.575	903.075, 903.575, 904.075...	927.075
3	902.625	903.125, 903.625, 904.125...	927.125
4	902.675	903.175, 903.675, 904.175...	927.175
5	902.725	903.225, 903.725, 904.225...	927.225
6	902.775	903.275, 903.775, 904.275...	927.275
7	902.825	903.325, 903.825, 904.325...	927.325
8	902.875	903.375, 903.875, 904.375...	927.375
9	902.925	903.425, 903.925, 904.425...	927.425
10	902.975	903.475, 903.975, 904.475...	927.475

Table 6b.2.4.1. MOTOtalk ISM Band Transmitter Frequency Hop Sets.

6b.2.5 MOTOtalk ISM Band Average Time of Occupancy – Pursuant 47 CFR 15.247(a)(1)(i); RSS-210 Section A8.1.

Worst-case scenario (continuous transmission) is as follows:

- 85.6 ms bursts at 90 ms intervals (hop intervals)
- 20 seconds per window / 0.09 seconds per hop = 222.22 hops per window
- 222.22 hops / 50 carriers = 4.444 bursts per carrier window
- 4.444 bursts * 0.0856 seconds per burst = 0.38 seconds.

The calculations show the average time of occupancy of 0.4 seconds or less.

Verification of burst is shown in the Figure below.

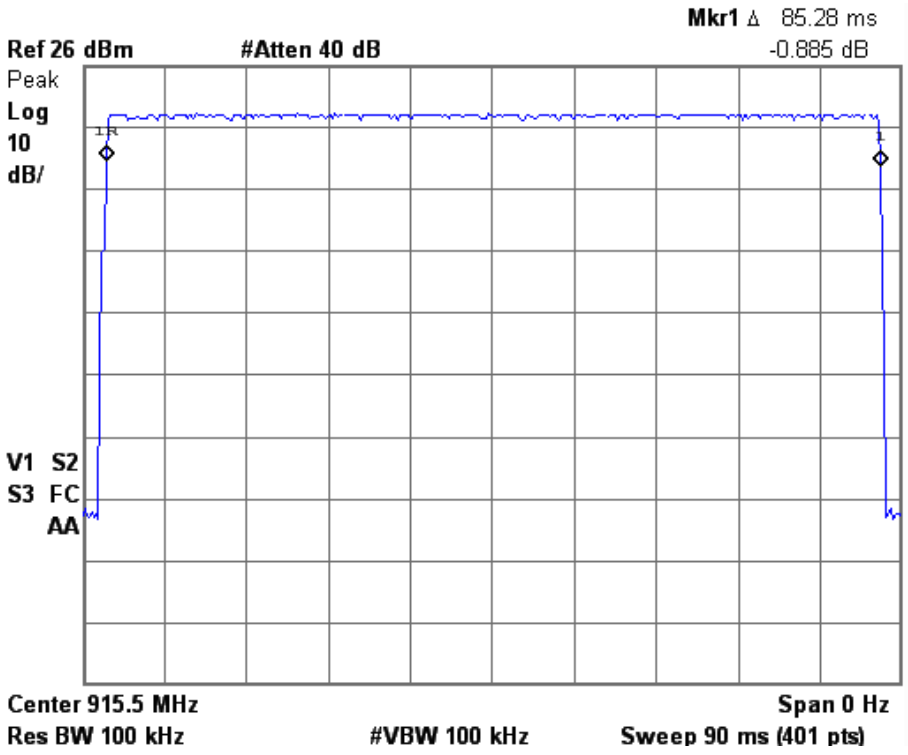


Figure 6b.2.5.1. MOTOtalk ISM Band Average Measured Time of Occupancy.

6b.2.6 MOTOtalk ISM Band Equal Distribution of Hopping Frequencies for Continuous Transmission – Pursuant 47 CFR 15.247(a)(1)(i) & 15.247(g); RSS-210 Section A8.1.

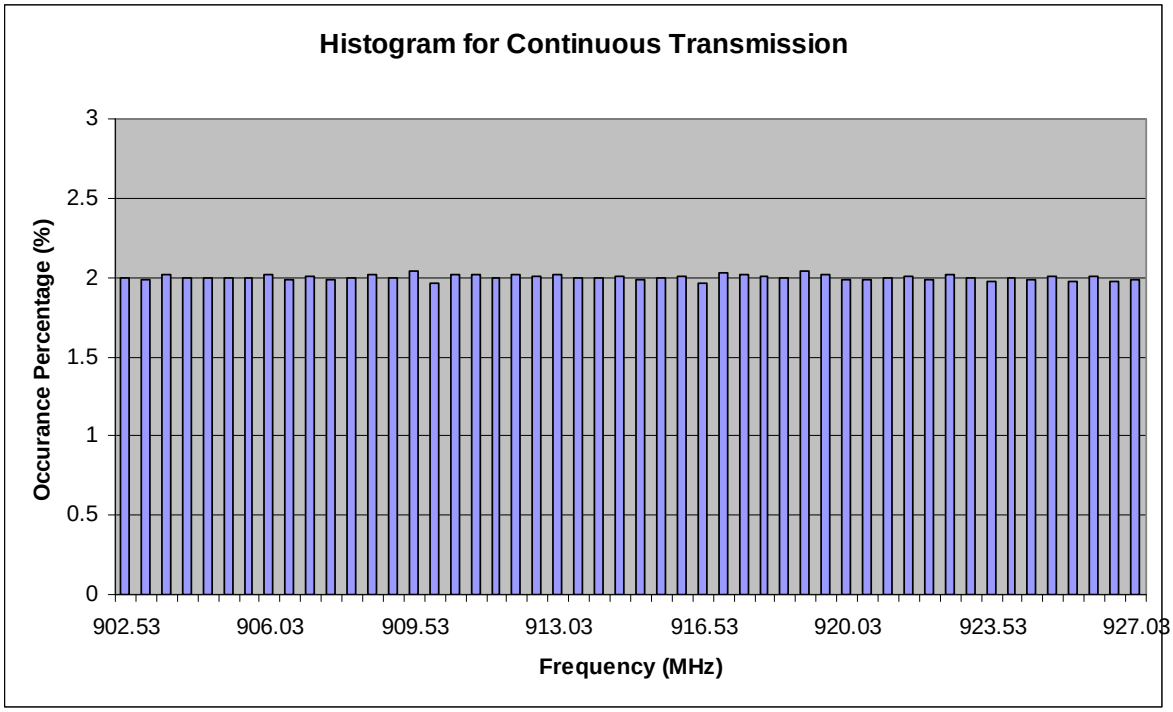


Figure 6b.2.6.1. Histogram of MOTOtalk ISM Band Continuous Transmission.

6b.2.7 MOTOtalk ISM Band Equal Distribution of Hopping Frequencies for Discontinuous Transmission - Pursuant 47 CFR 15.247(a)(1)(i) and 15.247(g); RSS-210 Section A8.1.

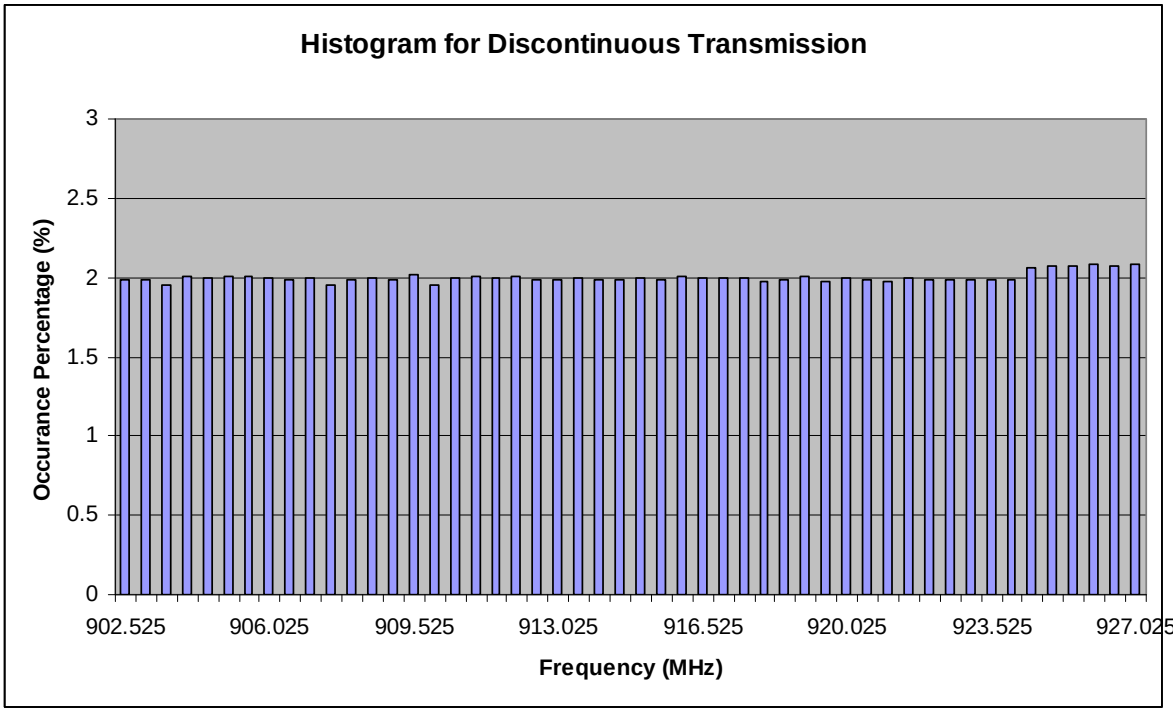


Figure 6b.2.7.1. Histogram of MOTOtalk ISM Band Discontinuous Transmissions.

6c.b MOTOtalk 900 MHz ISM Band Radiated Spurious Emissions -- Pursuant 47 CFR 2.1051, §2.1053, and §15.247; RSS-Gen Section 3, RSS-210 A8.5.

FCC Limits:

§15.247. In any 100 kHz bandwidth outside the frequency bands, the radio frequency power that is produced by the modulation products of the spreading sequence, the information sequence and the carrier frequency shall be either at least 20 dB below that in any 100 kHz bandwidth within the band that contains the highest level of the desired power or shall not exceed the general levels specified in Sec. 15.209, whichever results in the lesser attenuation. All other emissions outside these bands shall not exceed the general radiated emission limits specified in Sec. 15.209.

§15.35. States the peak of the harmonics shall not exceed 20 dB above the limits specified in §15.209.

Restricted bands specified in §15.205 in the table below:

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
[1] 0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2655–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	([2])
13.36–13.41			

[1] Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.
[2] Above 38.6

NOTE 1: Spurious emissions are dependent on the linearity of the Power Amplifier (U2051) and are independent of modulation type or TDM interleaving.

NOTE 2: Spurious emission levels were measured with the non-detachable antenna mounted on the radio product, as in intended use.

NOTE 3: An asterisk (*) in the data indicates the spurious emission could not be detected due to noise limitations or ambient conditions.

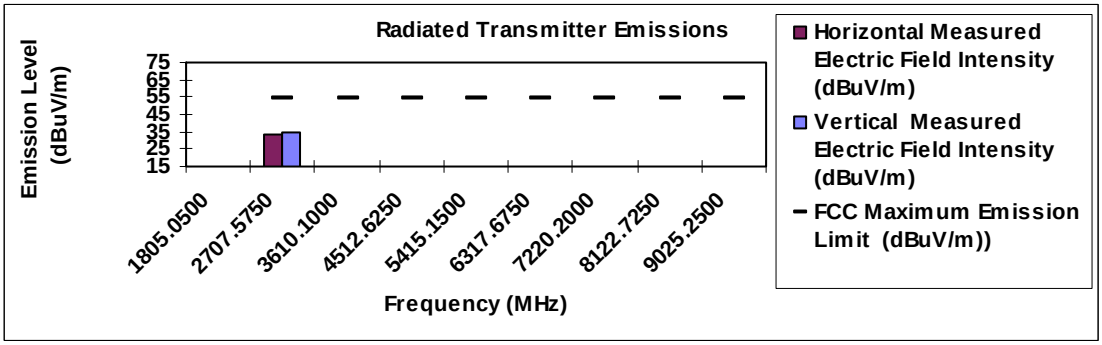
NOTE 4: The duty cycle correction factor (see Exhibit 7a) was applied to these data.

NOTE 5: Emissions resulting from intermodulation products possible due to the simultaneous operation of the MOTOtalk and Bluetooth transmitters were investigated and those of significance are shown in the graphs below. All were compliant with Part 15 emissions requirements, including those of the restricted bands.

Transmitter Radiated Spurious Emissions : i465 @ 3 meters

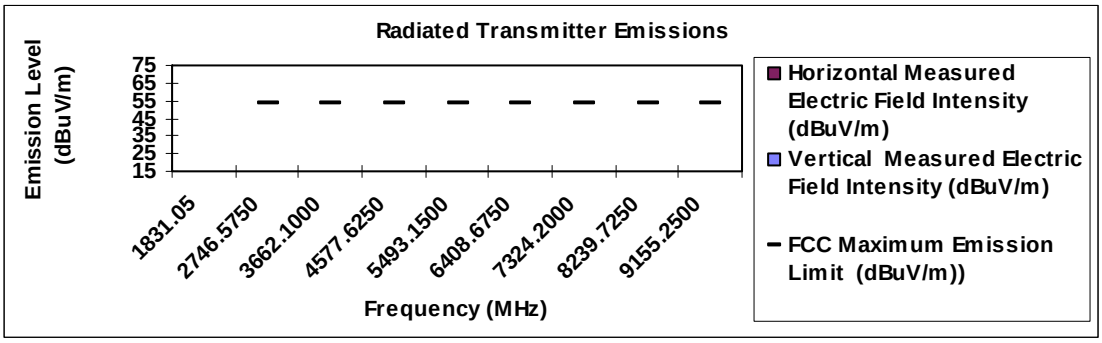
902.525 MHz **Ch.Sp.: 25kHz** **ISM Watts | S/N 364VJYJS2S**

Frequency (MHz)	FCC Maximum Emission Limit (dBuV/m))	Horizontal Measured Electric Field Intensity (dBuV/m)	Vertical Measured Electric Field Intensity (dBuV/m)
1805.0500	Hor. 98 / Vert. 106	*	*
2707.5750	54	33.73	34.82
3610.1000	54	*	*
4512.6250	54	*	*
5415.1500	54	*	*
6317.6750	54	*	*
7220.2000	54	*	*
8122.7250	54	*	*
9025.2500	54	*	*



915.525 MHz **ISM Watts | S/N 364VJYJS2S**

Frequency (MHz)	FCC Maximum Emission Limit (dBuV/m))	Horizontal Measured Electric Field Intensity (dBuV/m)	Vertical Measured Electric Field Intensity (dBuV/m)
1831.05	Hor. 97 / Vert. 105	*	*
2746.5750	54	*	*
3662.1000	54	*	*
4577.6250	54	*	*
5493.1500	54	*	*
6408.6750	54	*	*
7324.2000	54	*	*
8239.7250	54	*	*
9155.2500	54	*	*



* Indicates the spurious emission could not be detected due to noise limitations or ambients.

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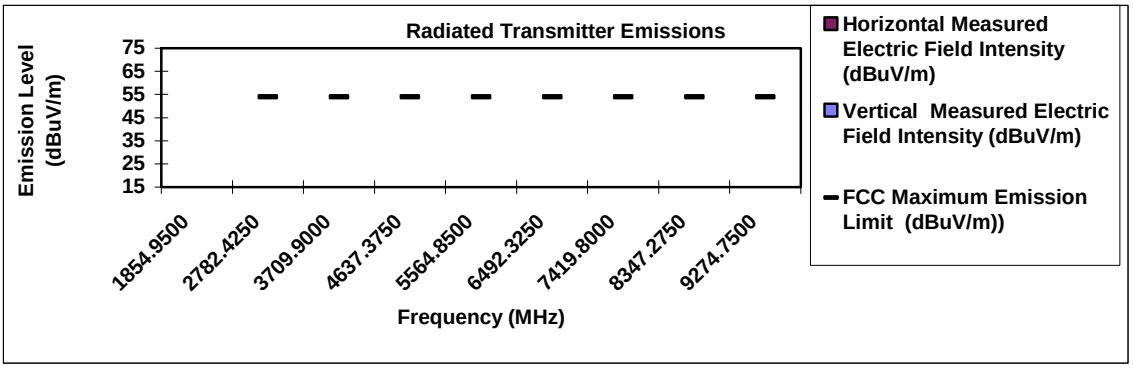
Figure 6b-3.1: MOTOtalk 900 MHz ISM Band Radiated Spurious Emissions – low and mid-band.

Transmitter Radiated Spurious Emissions: i465 @ 3 meters

927.475 MHz Ch.Sp.: 25kHz ISM Watts | S/N 364VJYJS2S

Frequency (MHz)	FCC Maximum Emission Limit (dBuV/m))	Horizontal Measured Electric Field Intensity (dBuV/m)	Vertical Measured Electric Field Intensity (dBuV/m)
1854.9500	Hor. 96 / Vert. 105	*	*
2782.4250	54	*	*
3709.9000	54	*	*
4637.3750	54	*	*
5564.8500	54	*	*
6492.3250	54	*	*
7419.8000	54	*	*
8347.2750	54	*	*
9274.7500	54	*	*



* Indicates the spurious emission could not be detected due to noise limitations or ambients.

Motorola Plantation EMC Lab – Test Performed by: Frank Baader January 27, 2009
FCC Registration: 91932 / Industry Canada: IC109U-1

Figure 6b-3.2: MOTOtalk 900 MHz ISM Band Radiated Spurious Emissions – upper band edge.

6b.4 Frequency Stability in the MOTOtalk ISM Band -- 47 CFR 47 CFR 2.1055a(1) and §2.1055(d)(2); RSS-Gen Section 3, RSS-210 Section 2.1.

The transmitter was set to transmit on a single frequency of 915.525 MHz using a special test mode not accessible by the user. The data shown below shows the maximum frequency excursion due to temperature and voltage extremes.

Frequency Stability (in ppm) at 915.525 MHz, Voltage = 4V_{DC}		
TEMP (ºC)	**Frequency Error (Hz)**	**Error (ppm)**
-30	141	0.154
-20	82	0.090
-10	27	0.029
0	17	0.019
10	96	0.105
20	135	0.147
30	77	0.084
40	119	0.130
50	31	0.034
60	80	0.087

Table 6b.4.1 Transmitter Frequency Stability vs. Temperature at 915.525 MHz.

Frequency Stability (in ppm) at 915.525 MHz, Temperature = 25°C		
Power Supply Output Voltage (V)	**Frequency Error (Hz)**	**Error (ppm)**
3.55	44	0.047
3.6	64	0.068
3.7	98	0.104
3.8	66	0.07
3.9	28	0.03
4.0	128	0.135
4.1	79	0.084
4.2	149	0.158

Table 6b.4.2 Transmitter Frequency Stability vs. Voltage at 915.525 MHz.

6b.5 Effective Radiated Power (ERP) – 47 CFR 2.1046 and §15.247(b)(3); RSS-Gen Section 3.2, RSS-210 Section A8.4.

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.

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

= 27.55 dBm

The resulting max ERP was converted to mW:

$$MeasuredMaxERP, mW = 10^{\left(\frac{Measured\ MaxERP, dBm}{10}\right)} = 568.85\ mW$$

Since the measured max ERP was not determined at the production maximum output power, a simple scaling is performed to 890 mW:

*Scaled Max ERP, mW = Measured ERP, mW * (890mW / measured output power, mW)*

= 681.4 mW

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

Conducted voltage limits:

This radio product can transmit in the MOTOtalk 900 MHz ISM Band while resting in a battery charger that is connected to the AC power line. Phase and Neutral traces are shown below, in addition to the two applicable limit lines, the higher being applicable to measurements utilizing a quasi-peak detector and the lower being applicable to measurements utilizing an average detector. The data trace portrays the amplitude of the voltage measured during sweeping with a quasi-peak detector. The table below the traces shows the measured values at frequencies of interest, including measurements made with the averaging detector.

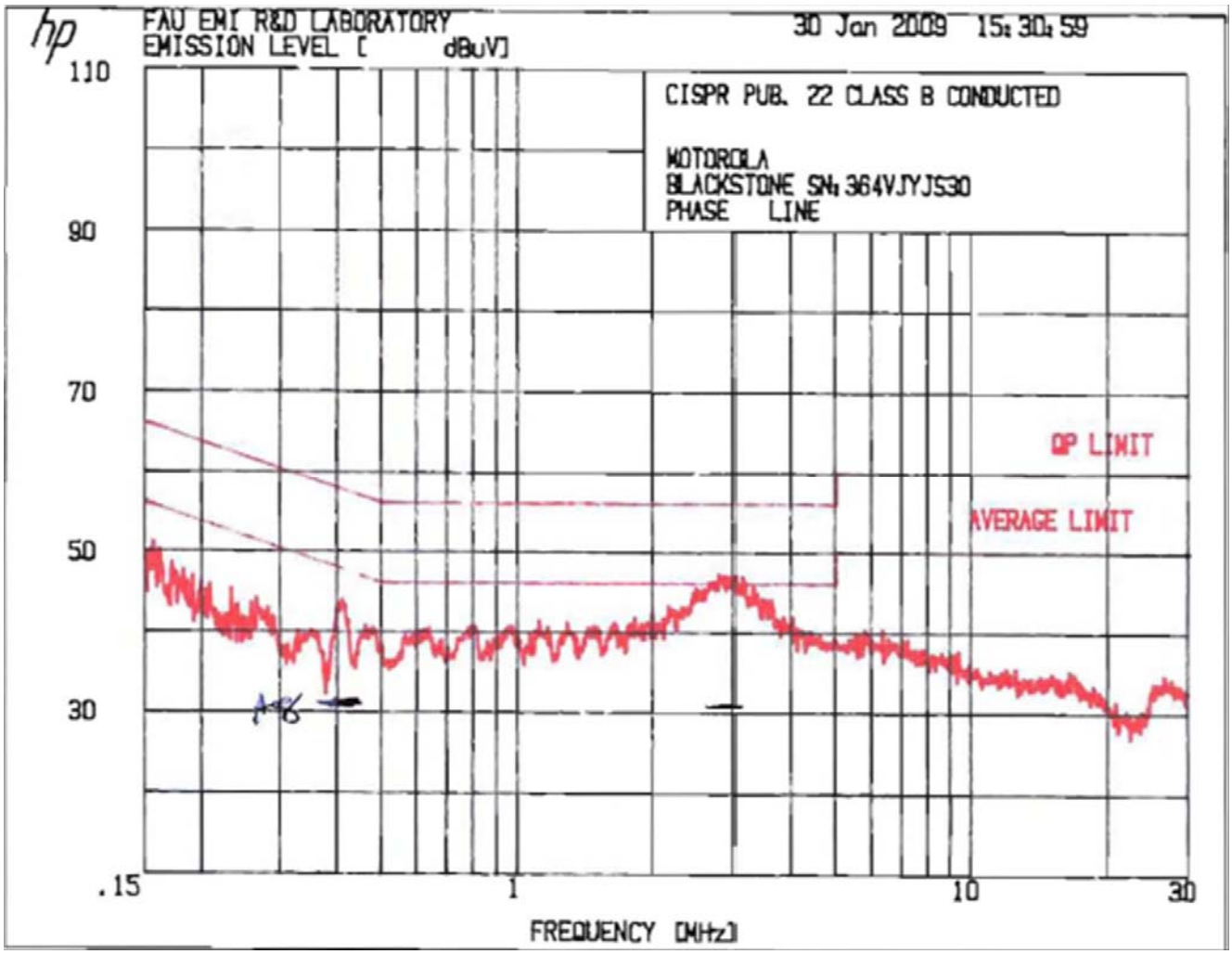


Figure 6b-6.1: MOTOtalk 900 MHz ISM Band Phase Line Voltage at 902.525 MHz, with a Quasi-Peak Detector

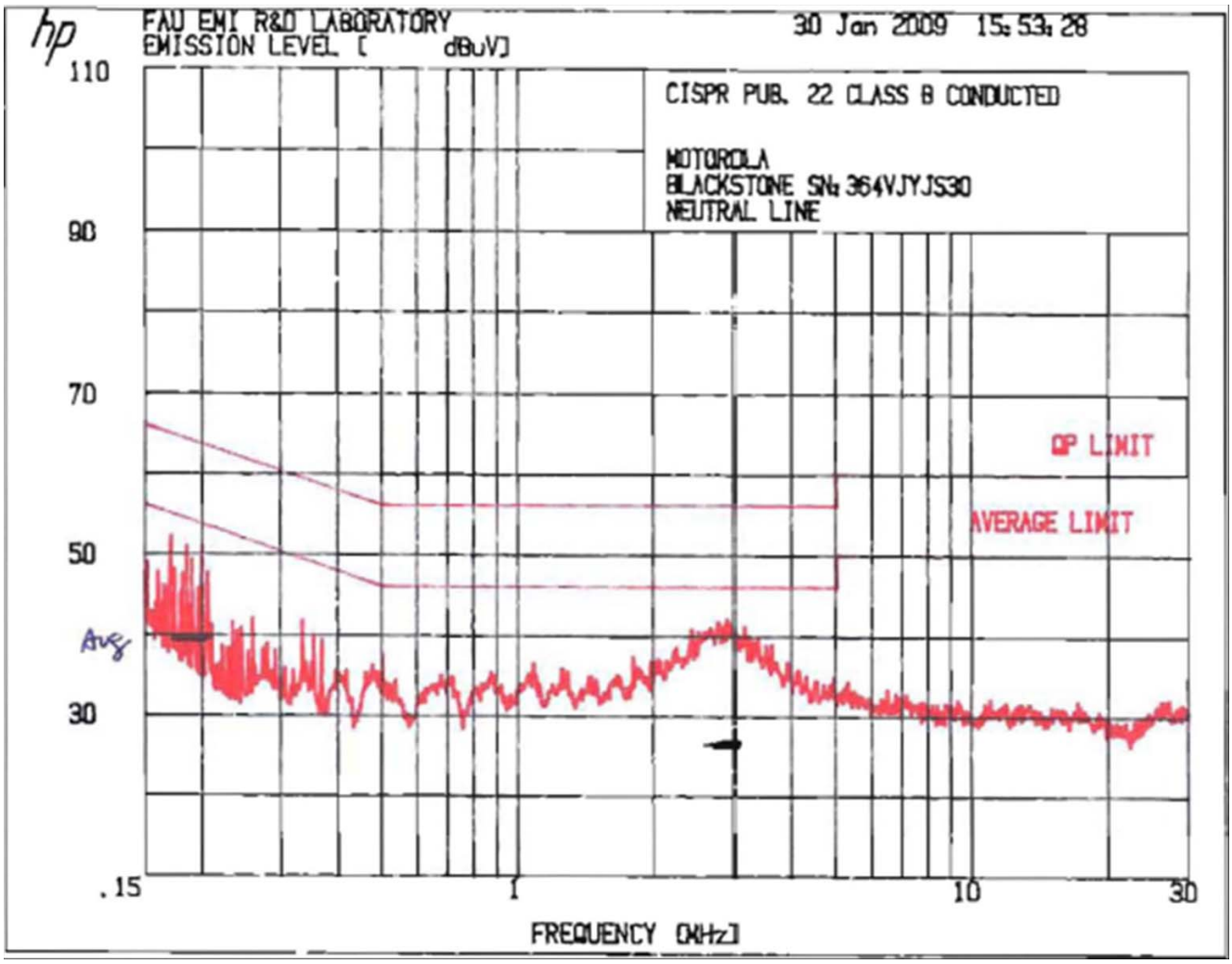


Figure 6b-6.2: MOTOtalk 900 MHz ISM Band Neutral Line Voltage at 902.525 MHz, with a Quasi-Peak Detector.

MOTOtalk							
Line Tested	**Frequency (kHz)**	**Peak Value (dBµV)**	**QP Value (dBµV)**	**Average Value (dBµV)**	**Avg. Limit (dBµV)**	**Margin to Avg. Limit (dB)***	
Phase	426.34	42.70		30.53	47.32	16.79	TX
Neutral	178.06	57.86		39.51	54.58	15.07	
Phase	2961	44.54		30.35	46.00	15.65	
Neutral	2813	41.07		27.14	46.00	18.86	

Table 6b-6.1: Line Voltage Data: Quasi-Peak and Average