Mobile Devices business
iDEN Mobile Devices Operations

RF Test Report

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

Product Name: i786/i786w-Series
FCC ID: IHDP56LM1
IC ID: 109O-P56LM1

Date: October 4, 2010

Table of Contents

[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: (954) 723-5480 FCC Registration Number: **91932** Industry Canada Number: **IC109U-1**
	TIMCO Engineering Laboratory details in report FCC Registration Number: **95517** Industry Canada Number: **2056A**
Product Type:	Cellular Phone
Signaling Capabilities:	MOTOtalk 900 MHz ISM
FCC ID:	IHDP56LM1
IC ID:	109O-P56LM1

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, TIA/EIA-603-C, and ANSI C63.4-2009.

Exhibit 6b.1: 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 800 mW (29.0 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)	1.462
Output Power (mW)	800

Table 6b.1-1 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.

Criterion: Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

The measurement shows a carrier frequency separation of 500 kHz, which is greater than the measured 20 dB bandwidth of 27.25 kHz.

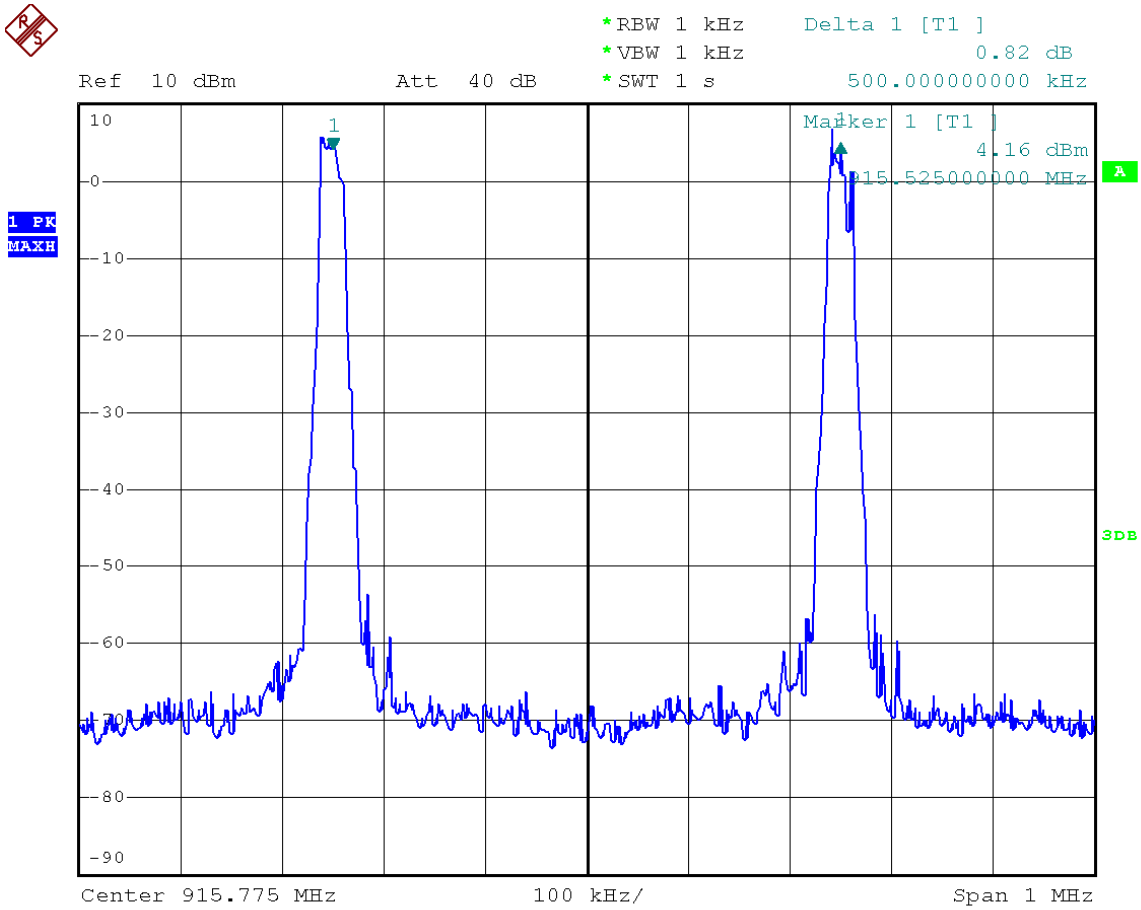


Figure 6b.2.1.1. Plot of MOTOtalk ISM Band adjacent channel separation within a hop set.

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 20 dB bandwidth of 25.6 kHz at 902.525 MHz. The plot shows at least 20 dBc with the 50 kHz offset from the carrier.

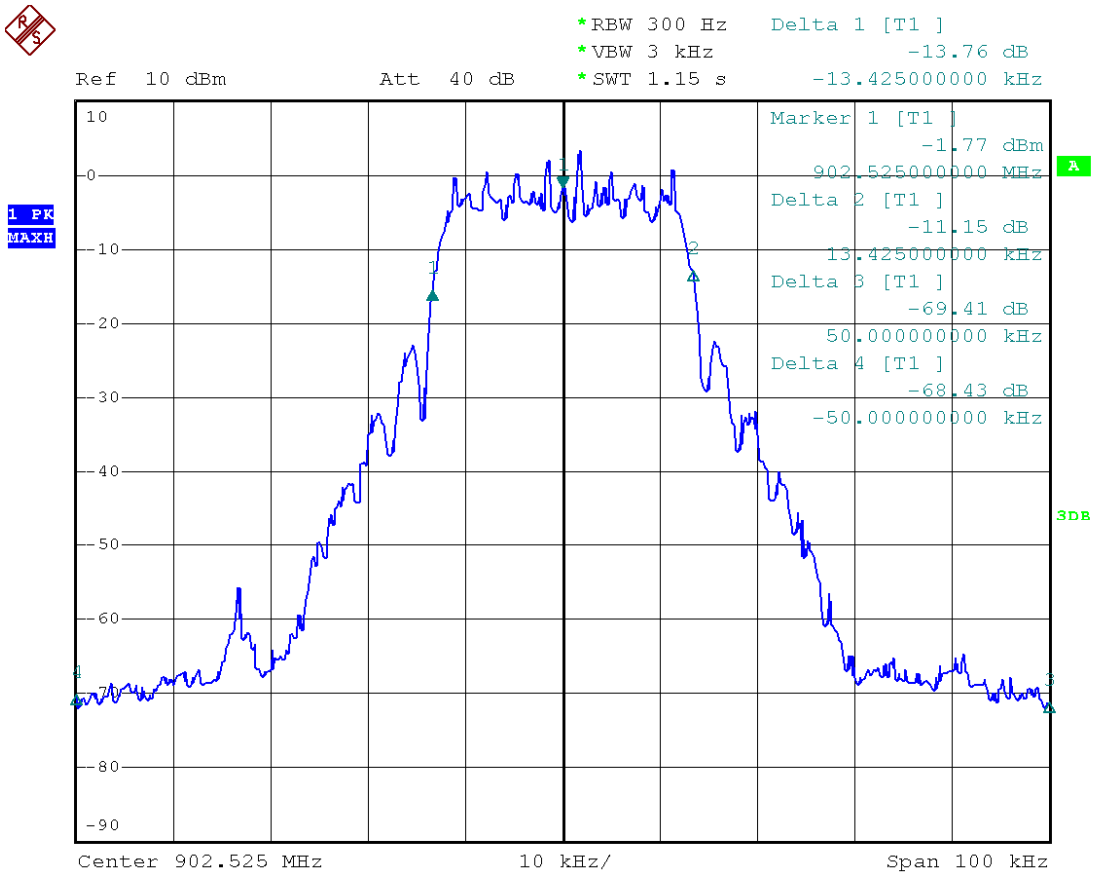


Figure 6b.2.2.1 Spectrum analyzer plot of MOTOtalk ISM Band 8-FSK traffic channel signal's 99% bandwidth at center frequency 902.525 MHz, with hopping function disabled.

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.

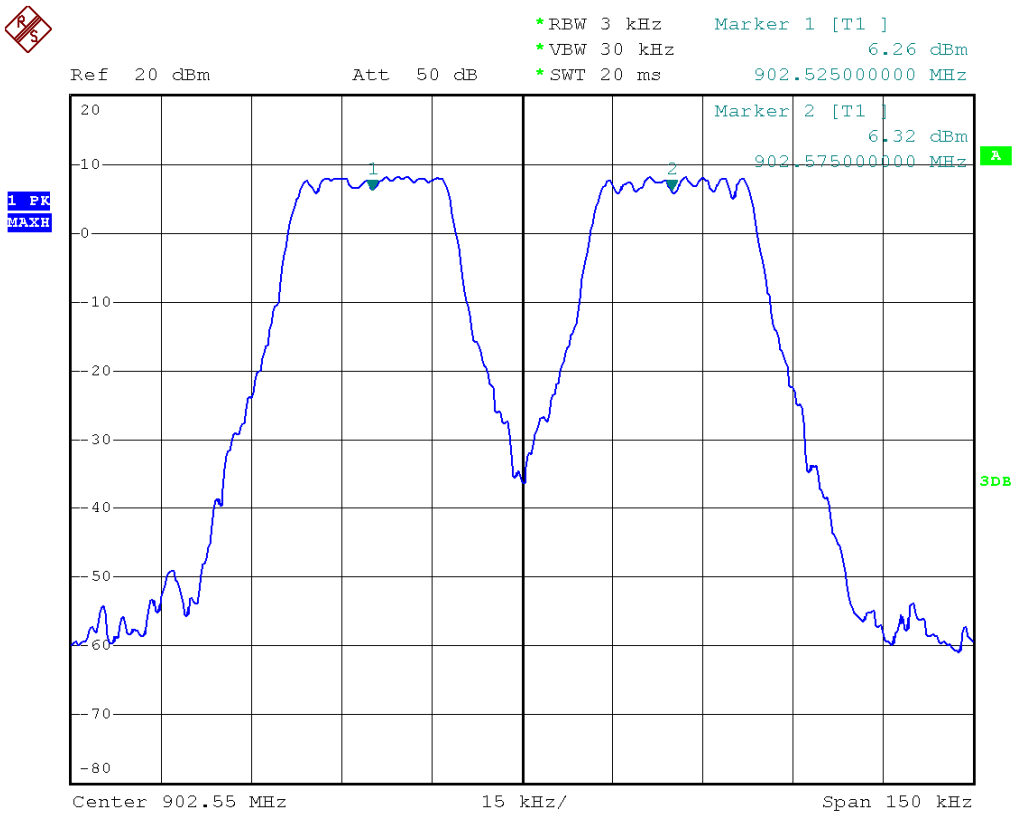


Figure 6b.2.2.2. Adjacent hop set separation with spectrum analyzer center frequency at 902.55 MHz.

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 20dB (measured value here is 63.25 dB) below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

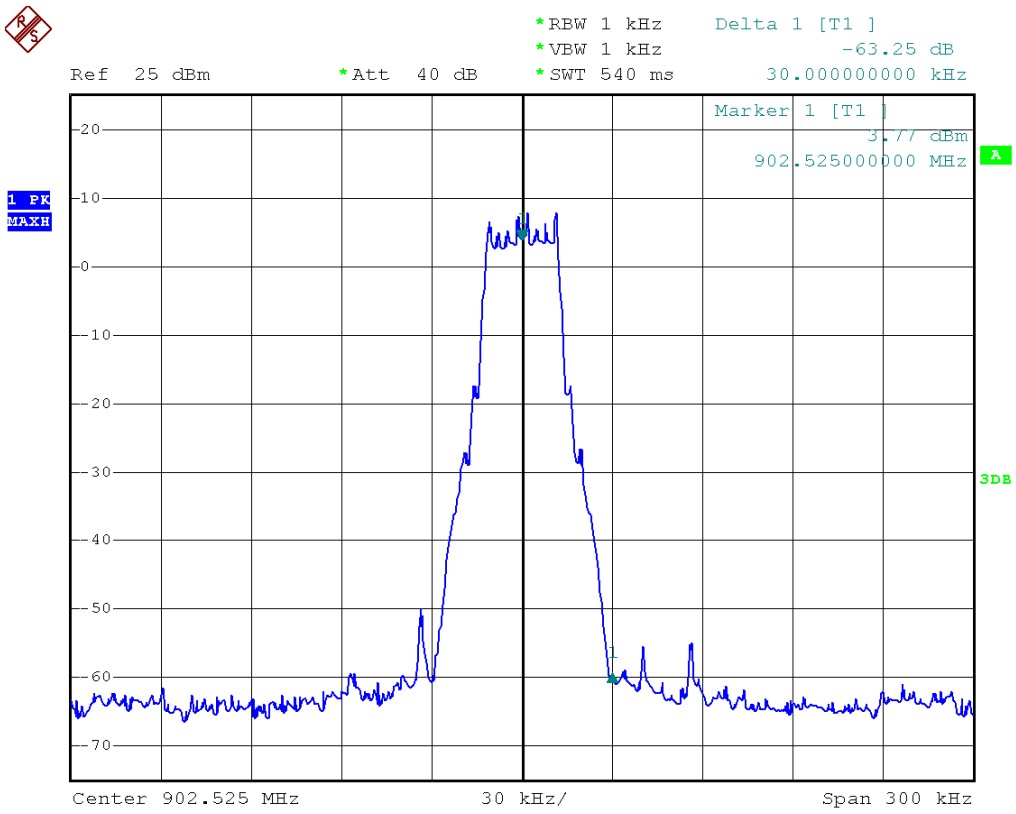
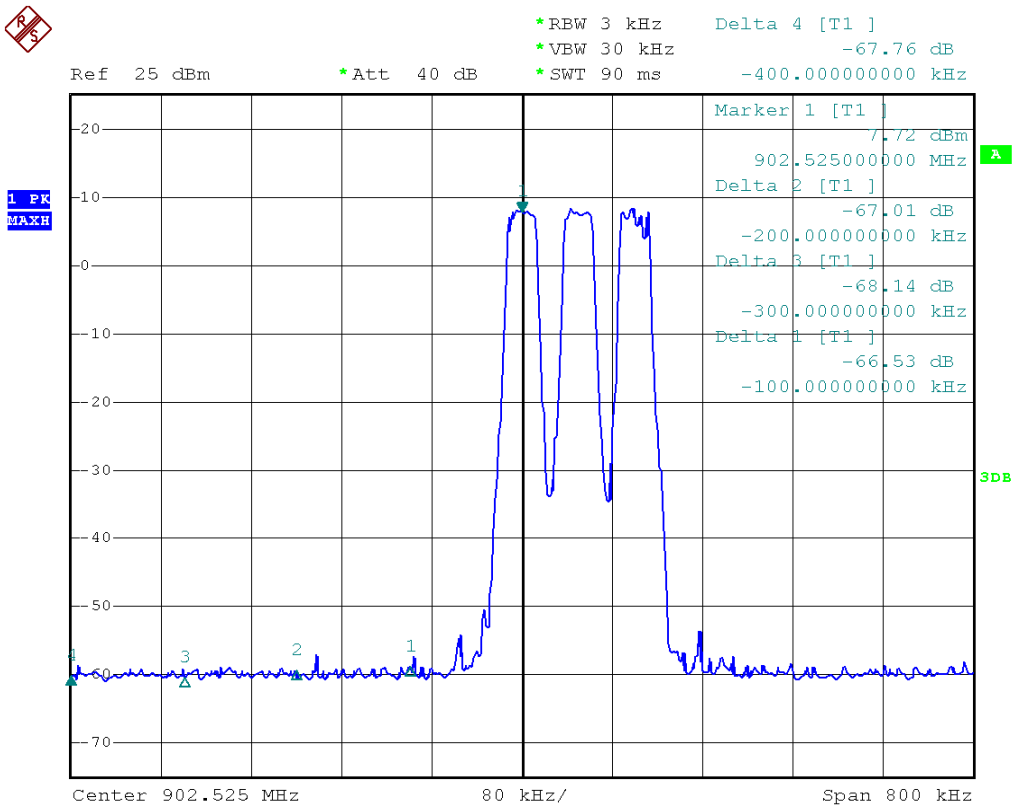


Figure 6b.2.2.3 MOTOtalk ISM band occupied bandwidth with frequency span of 300 kHz with hopping function disabled at center frequency 902.525 MHz.



Date: 2.AUG.2010 14:07:56

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 27.25 kHz at 927.475 MHz. The plot shows spurious emissions attenuation of at least 20 dBc, with the 50 kHz offset from the carrier.

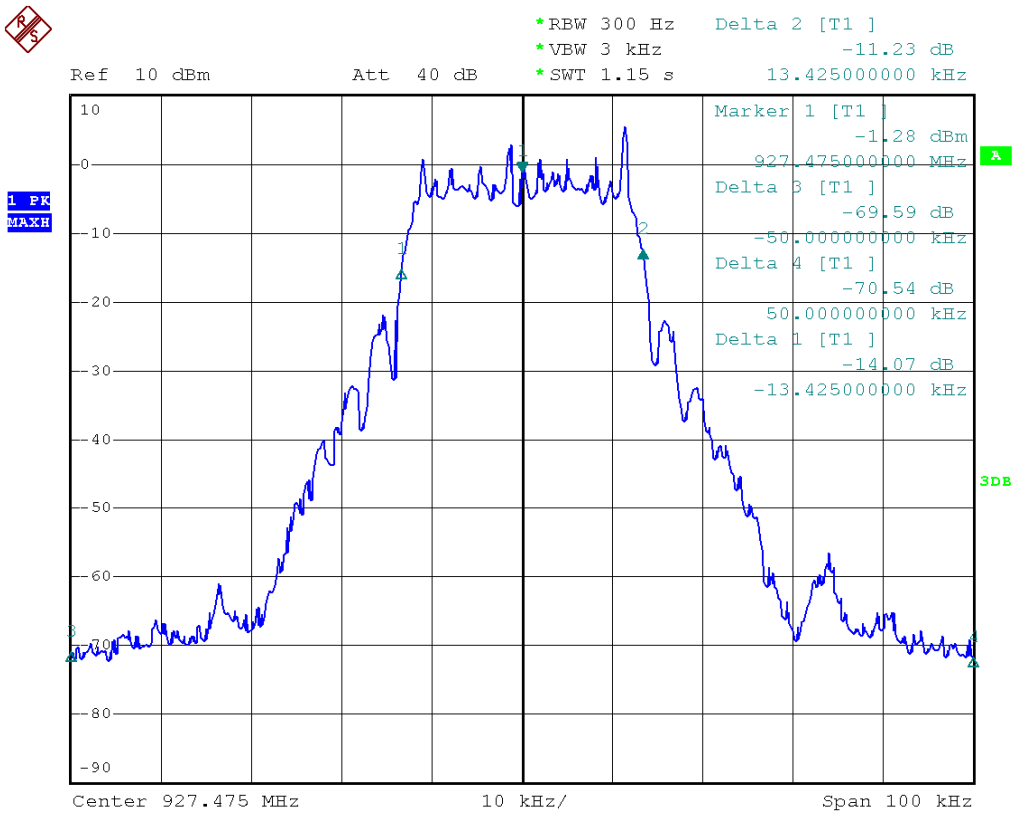


Figure 6b.2.2.5 Spectrum analyzer plot of MOTOtalk ISM Band 8-FSK traffic channel signal's 99% bandwidth with hopping function disabled, at center frequency 927.475 MHz.

The adjacent hop set channel separation was measured between hopset9 @ 927.475 MHz and hopset10 @ 927.525 MHz which is 50 kHz.

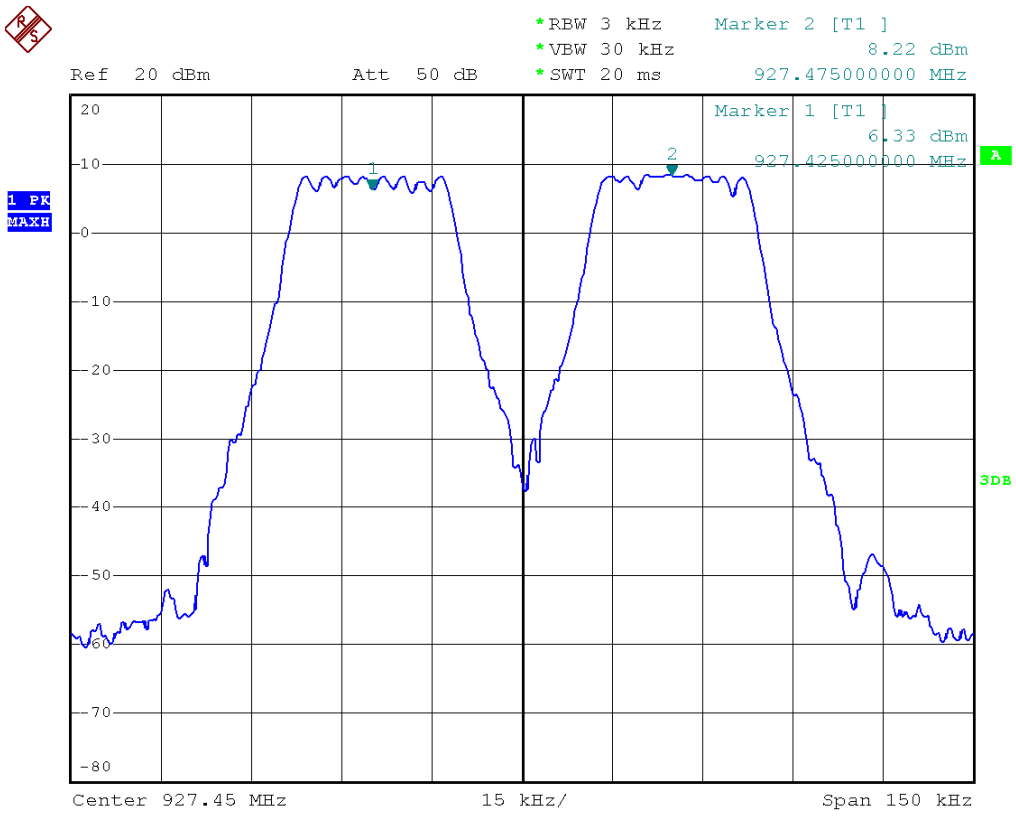


Figure 6b.2.2.6. Adjacent hop set separation with spectrum analyzer center frequency 927.5 MHz.

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 63.36 dB) below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

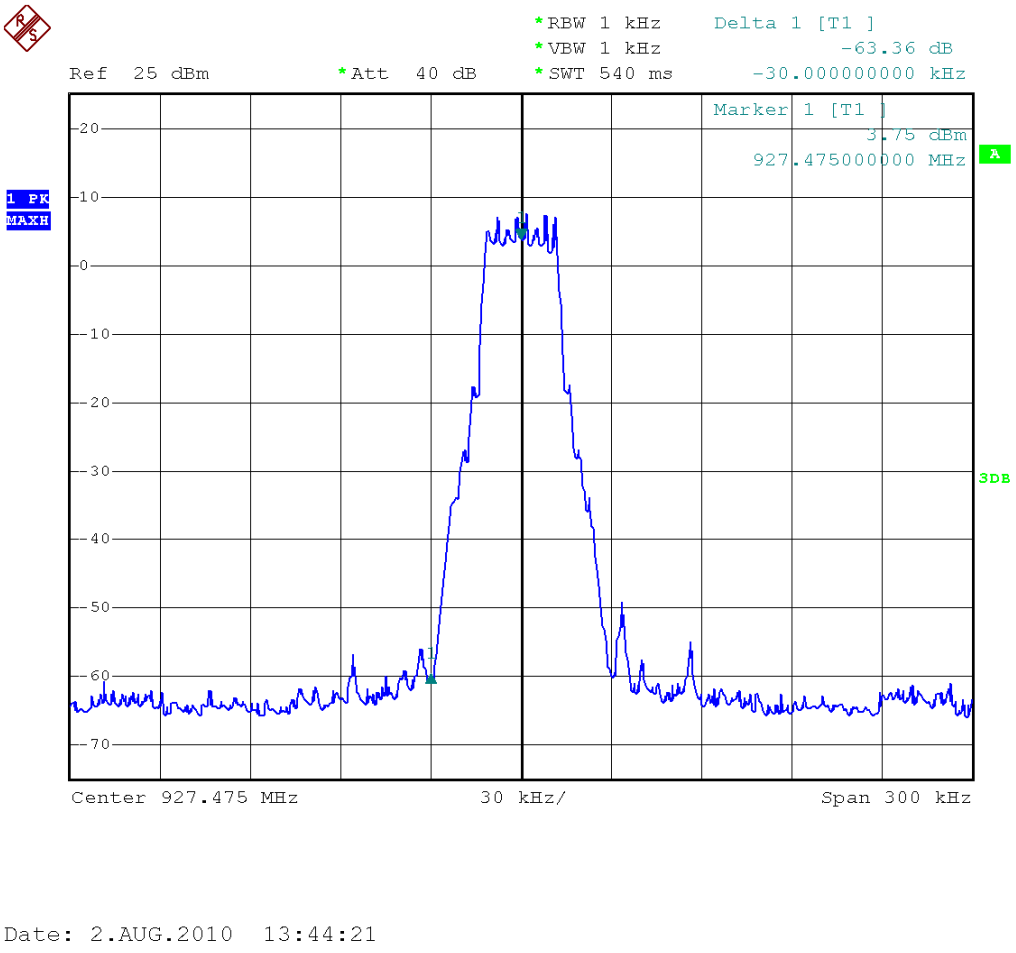


Figure 6b.2.2.7 MOTOtalk ISM band occupied bandwidth with frequency span of 300 kHz with hopping function disabled, at center frequency 927.475.

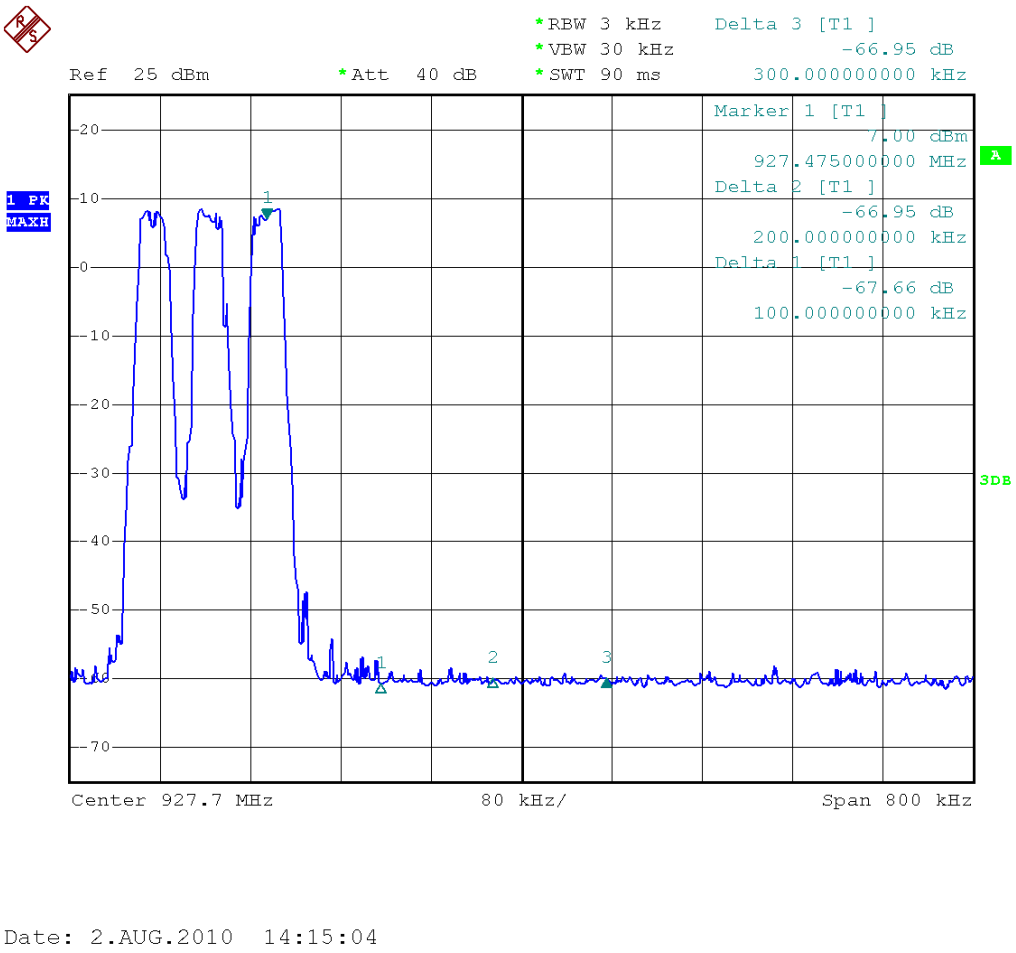


Figure 6b.2.2.8. Out-of-band transmitter spurious emissions high band edge, with hopping function enabled.

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 Sine 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.

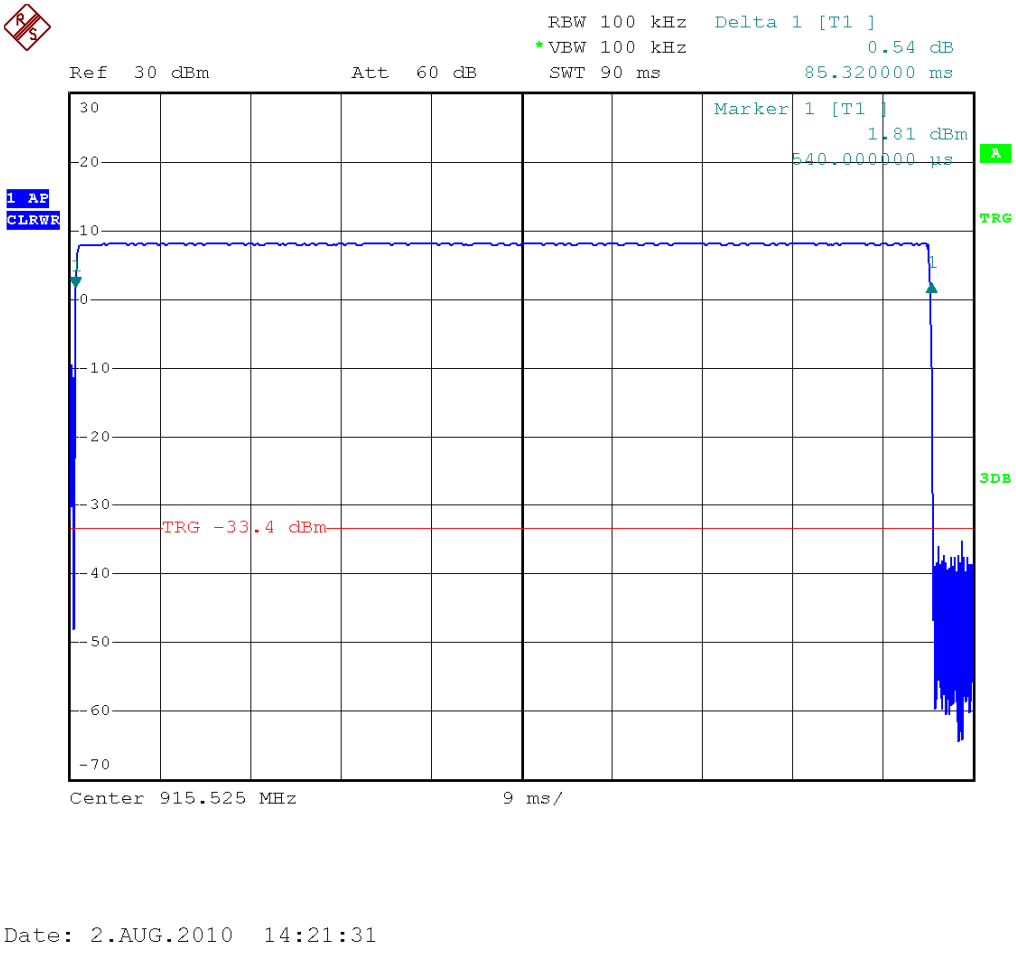


Figure 6b.2.5.1. MOTOtalk ISM Band Average Measured Time of Occupancy.

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.

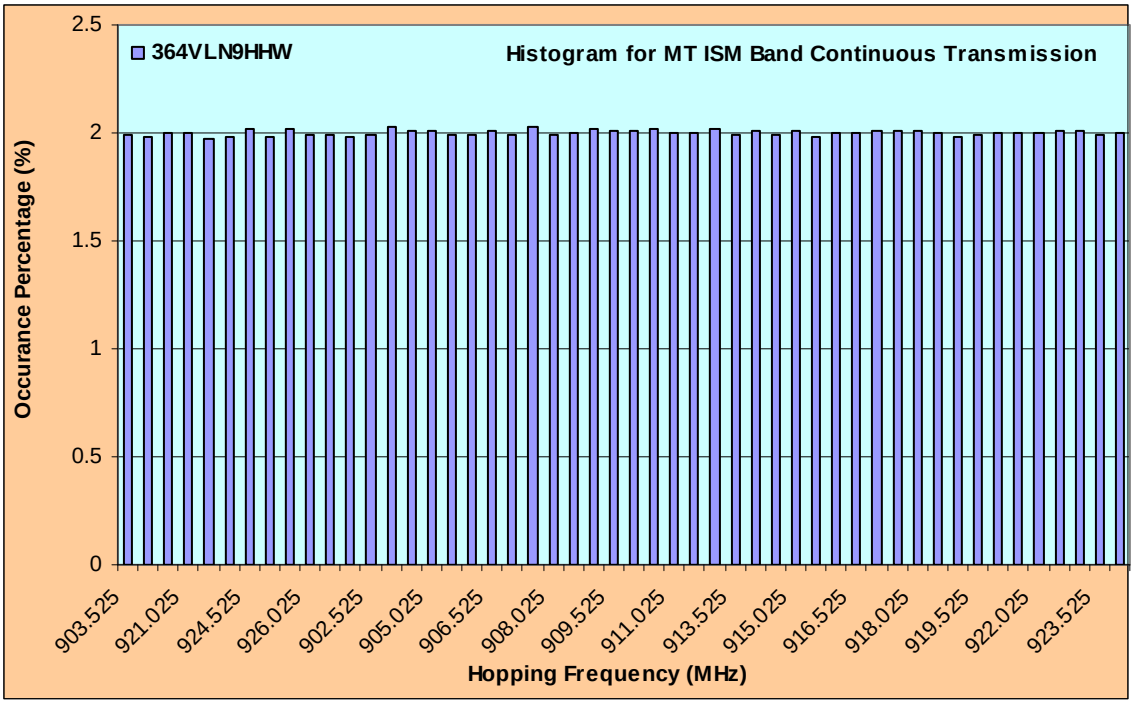


Figure 6b.2.6.1. Histogram of MOTOtalk ISM Band Continuous Transmission.

INDEX	NO	FREQ	INDEX	NO	FREQ	INDEX	NO	FREQ
1	1254	903.525	18	1252	906.025	34	1263	915.025
2	1248	921.525	19	1267	906.525	35	1247	915.525
3	1260	912.525	20	1253	907.025	36	1261	916.025
4	1258	921.025	21	1275	907.525	37	1260	916.525
5	1244	903.025	22	1252	908.025	38	1262	917.025
6	1246	912.025	23	1261	908.525	39	1263	917.525
7	1270	924.525	24	1271	909.025	40	1263	918.025
8	1247	925.025	25	1265	909.525	41	1259	918.525
9	1270	925.525	26	1263	910.025	42	1250	919.025
10	1256	926.025	27	1269	910.525	43	1254	919.525
11	1251	926.525	28	1260	911.025	44	1260	920.025
12	1249	927.025	29	1257	911.525	45	1260	920.525
13	1254	902.525	30	1269	913.025	46	1261	922.025
14	1274	904.025	31	1254	913.525	47	1266	922.525
15	1262	904.525	32	1264	914.025	48	1264	923.025
16	1262	905.025	33	1254	914.525	49	1255	923.525
17	1252	905.525				50	1258	924.025

Table 6b.2.6.1. Distribution 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.

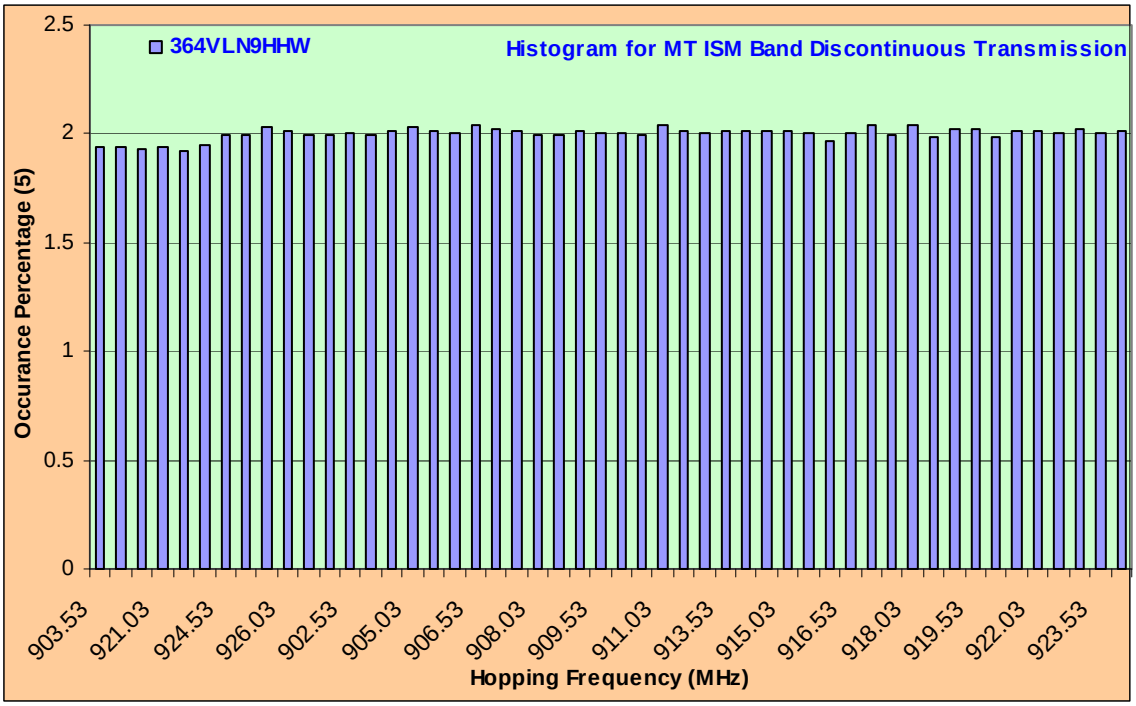


Figure 6b.2.7.1. Histogram of MOTOtalk ISM Band Discontinuous Transmissions.

INDEX	NO	FREQ	INDEX	NO	FREQ	INDEX	NO	FREQ
1	3183	903.525	18	3298	906.025	34	3312	915.025
2	3194	921.525	19	3349	906.525	35	3292	915.525
3	3179	912.525	20	3324	907.025	36	3233	916.025
4	3183	921.025	21	3302	907.525	37	3301	916.525
5	3160	903.025	22	3272	908.025	38	3355	917.025
6	3203	912.025	23	3277	908.525	39	3280	917.525
7	3274	924.525	24	3303	909.025	40	3348	918.025
8	3284	925.025	25	3292	909.525	41	3264	918.525
9	3338	925.525	26	3292	910.025	42	3317	919.025
10	3310	926.025	27	3284	910.525	43	3324	919.525
11	3284	926.525	28	3347	911.025	44	3261	920.025
12	3278	927.025	29	3310	911.525	45	3303	920.525
13	3293	902.525	30	3301	913.025	46	3309	922.025
14	3278	904.025	31	3303	913.525	47	3293	922.525
15	3303	904.525	32	3312	914.025	48	3326	923.025
16	3341	905.025	33	3306	914.525	49	3297	923.525
17	3303	905.525				50	3304	924.025

Table 6b.2.7.1. Distribution of MOTOtalk ISM Band Discontinuous Transmissions.

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	60.86	0.066
-20	0.41	0.000
-10	94.51	0.103
0	33.16	0.036
10	85.13	0.093
20	307.58	0.336
30	8.66	0.09
40	145.07	0.158
50	44.63	0.049
60	6.71	0.007

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	73.98	0.081
3.6	22.13	0.024
3.7	89.91	0.097
3.8	86.65	0.095
3.9	168.74	0.184
4.0	45.41	0.050
4.1	453.06	0.495
4.2	13.54	0.015
4.3	32.01	0.035

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.

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

= 26.44 dBm

The resulting max ERP was converted to mW:

$$MeasuredMaxERP, mW = 10^{\left(\frac{Measured\ MaxERP, dBm}{10}\right)} = 440.55\ mW$$

Since the measured max ERP was not determined at the production maximum output power, a simple scaling is performed to 800 mW:

Scaled Max ERP, mW = Measured ERP, mW * (800mW / measured output power, mW)

= 471.3 mW

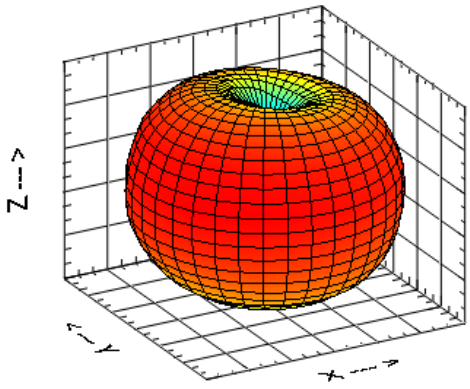


Figure 6b.5-1 Antenna pattern in the 900 MHz ISM frequency band (Flip Open).

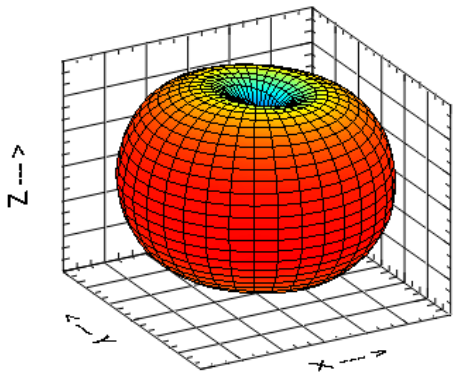


Figure 6b.5-2 Antenna pattern in the 900 MHz ISM frequency band (Flip Closed).

6b.5.1. De Facto EIRP Limit – Pursuant 47 CFR 15.247(b)(4); RSS-210 Section A8.4.

Criterion: The conducted output power limit of 1-watt is based on the use of antennas with directional gains that do not exceed 6 dB_i. If transmitting antennas of directional gain greater than 6 dB_i are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dB_i.

The antenna employed by this transmitter is intended to be omni-directional, and exhibits directional gain less than 6 dB_i (gain = -0.16 dB_i). The conducted power is, therefore, less than the limits set forth (see elsewhere in this report for details).