6.8.4.15. POINT TO POINT - Conducted RF Output Power & EIRP wrt. MaxRad Model MPR58029PTNF Directional Antenna (29 dBi Gain)

Channel No.	Channel Frequency (MHz)	Minimum Conducted Power (dBm)	Max Conducted Power Ratings (dBm)	Max Calculated EIRP (dBm)	FCC Conducted Power Limit (dBm)	FCC EIRP Limit (dBm)	Pass/Fail
1	5735	-18.6	24.56	53.56	30	No Limit	Pass
3	5775	-18.6	25.44	54.44	30	No Limit	Pass
4	5795	-18.6	25.84	54.84	30	No Limit	Pass
4A	5805	-18.6	25.95	54.95	30	No Limit	Pass
5	5815	-18.6	26.03	55.03	30	No Limit	Pass

6.8.4.16. POINT TO POINT - Conducted RF Output Power & EIRP wrt. MaxRad Model MPR68031PTNF Directional Antenna (31 dBi Gain)

Channel No.	Channel Frequency (MHz)	Minimum Conducted Power (dBm)	Max Conducted Power Ratings (dBm)	Max Calculated EIRP (dBm)	FCC Conducted Power Limit (dBm)	FCC EIRP Limit (dBm)	Pass/Fail
1	5735	-18.6	24.56	55.56	30	No Limit	Pass
3	5775	-18.6	25.44	56.44	30	No Limit	Pass
4	5795	-18.6	25.84	56.84	30	No Limit	Pass
4A	5805	-18.6	25.95	56.95	30	No Limit	Pass
5	5815	-18.6	26.03	57.03	30	No Limit	Pass

6.9. RF EXPOSURE REQUIRMENTS @ FCC 15.247(B)(4), 1.1310 & 2.1091

6.9.1. Limits

- 15.247(b)(4) NEW TECHNOLOGY DIGITAL MODULATION devices are subject to the radio frequency radiation exposure requirements specified in Sec. 1.1307(b), Sec. 2.1091 and Sec. 2.1093 of this chapter, as appropriate. All equipment shall be considered to operate in a ``general population/uncontrolled" environment. Applications for equipment authorization of devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the Commission upon request.
- **FCC 1.1310:**- The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b).

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Average Time (minutes)
(B) Limits for General Population/Uncontrolled Exposure				
1500-100,000	...	...	1.0	30

F = Frequency in MHz

6.9.2. Method of Measurements

Refer to FCC @ 1.1310, 2.1091

- New Technology Digital Modulation transmitters operating under section 15.247 are categorically from routine environmental evaluation to demonstrating RF exposure compliance with respect to MPE and/or SAR limits. These devices are not exempted from compliance (As indicated in Section 15.247(b)(4), these transmitters are required to operate in a manner that ensures that exposure to public users and nearby persons) does not exceed the Commission's RF exposure guidelines (see Section 1.1307 and 2.1093). Unless a device operates at substantially low power levels, with a low gain antenna(s), supporting information is generally needed to establish the various potential operating configurations and exposure conditions of a transmitter and its antenna(s) in order to determine compliance with the RF exposure guidelines.

- In order to demonstrate compliance with MPE requirements (see Section 2.1091), the following information is typically needed:

(1) Calculation that estimates the minimum separation distance (20 cm or more) between an antenna and persons required to satisfy power density limits defined for free space.
(2) Antenna installation and device operating instructions for installers (professional/unskilled users), and the parties responsible for ensuring compliance with the RF exposure requirement
(3) Any caution statements and/or warning labels that are necessary in order to comply with the exposure limits
(4) Any other RF exposure related issues that may affect MPE compliance

Calculation Method of RF Safety Distance:

$S = PG/4\Pi r^2 = EIRP/4\Pi r^2$

Where: P: power input to the antenna in mW
EIRP: Equivalent (effective) isotropic radiated power.
S: power density mW/cm^2
G: numeric gain of antenna relative to isotropic radiator
r: distance to centre of radiation in cm

FCC radio frequency exposure limits may be exceeded at distances closer than r cm from the antenna of this device

$r = \sqrt{PG/4\Pi S}$

FCC radio frequency exposure limits may not be exceeded at distances closer than r cm from the antenna of this device

- For portable transmitters (see Section 2.1093), or devices designed to operate next to a person's body, compliance is determined with respect to the SAR limit (define in the body tissues) for near-field exposure conditions. If the maximum average output power, operating condition configurations and exposure conditions are comparable to those of existing cellular and PCS phones., an SAR evaluation may be required in order to determine if such a device complies with SAR limit. When SAR evaluation data is not available, and the additional supporting information cannot assure compliance, the Commission may request that a SAR evaluation be performed, as provided for in Section 1.1307(d)

6.9.3. Test Data

6.9.3.1. For Point to Multipoint Application

According to Sec. 5.8.4 of this test report, the maximum EIRP is 3.75 Watts using MTI MODEL 485002 Antenna

Frequency of Maximum Peak Transmit Power sin Sec. 6.8 (GHz)	Measured Peak Conducted Transmit Power in Sec. 6.8 (dBm)	Maximum Antenna Gain (dBi)	Maximum EIRP (dBm)	Calculated Antenna Separation Distance (cm)
5.735	12.74	23.00	35.74	17.3 cm

Note 1: RF EXPOSURE DISTANCE LIMITS : $r = (PG/4\pi S)^{1/2} = (EIRP/4\pi S)^{1/2}$
$S = 1.0\ mW/cm^2$

6.9.3.2. For Point to Point Application

According to Sec. 5.8.4 of this test report, the maximum EIRP is 3.75 Watts using MTI MODEL 485002 Antenna

Frequency of Maximum Peak Transmit Power sin Sec. 6.8 (GHz)	Measured Peak Conducted Transmit Power in Sec. 6.8 (dBm)	Maximum Antenna Gain (dBi)	Maximum EIRP (dBm)	Calculated Antenna Separation Distance (cm)
5.735	26.03	31.2	57.23	205

Note 1: RF EXPOSURE DISTANCE LIMITS : $r = (PG/4\pi S)^{1/2} = (EIRP/4\pi S)^{1/2}$
$S = 1.0\ mW/cm^2$

Evaluation of RF Exposure Compliance Requirements	
RF Exposure Requirements	**Compliance with FCC Rules**
Minimum calculated separation distance between antenna and persons required: • 17.3 centimeters for Point to Point application • 2.1 meters for Point to Point application.	Manufacturer' instruction for separation distance between antenna and persons required: 2.1 meters

6.10. TRANSMITTER BAND-EDGE & SPURIOUS EMISSIONS (CONDUCTED), FCC CFR 47, PARA. 15.247(C)

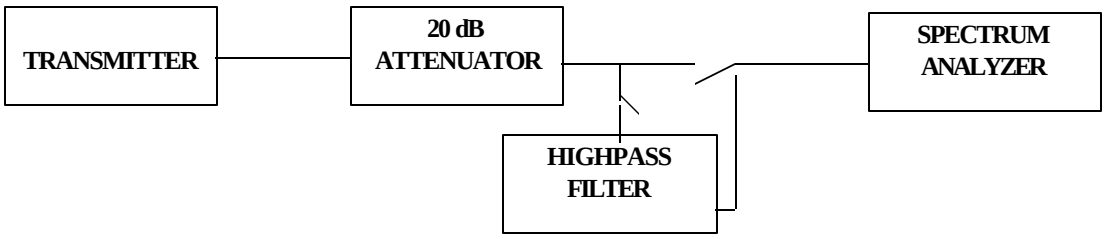
6.10.1. Limits

In any 100 kHz bandwidth outside the frequency band in which the New Technology Digital Modulation intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Sec. 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Sec. 15.205(a), must also comply with the radiated emission limits specified in Sec. 15.209(a) (see Sec. 15.205(c)).

6.10.2. Method of Measurements

Refer to Exhibit 8, Sec. 8.5.1 of this test report, FCC 15.247(c) & ANSI C63-4:1992

6.10.3. Test Arrangement



6.10.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Hewlett Packard	HP 8593EM	3412A00103	9 kHz – 26.5 GHz

6.10.5. Plots & Test Data

- Please refer to Plots # 13 through 60 in Annex 1 for Conducted Band-edge and Spurious/Harmonic Emissions with different modulations { 64 QAM (maximum data rate: 54 Mb/s), 16QAM (Maximum data rate: 36 Mb/s), QPSK (Maximum data rate: 18 Mb/s) and BPSK (Maximum Data Rate: 9 Mb/s) } and maximum rf conducted power output.
- Please refer to Plots # 61 through 72 in Annex 1 for Conducted Band-edge and Spurious/Harmonic Emissions with modulation of 64 QAM (maximum data rate: 54 Mb/s and minimum rf conducted power output (-18.6 dBm). The test with other modulations are not necessarily repeated since the results were exactly identical as observed from maximum power test as detailed in Plots 13 to 61.

6.11. TRANSMITTED POWER DENSITY OF A DIGITAL MODULATION SYSTEM, FCC CFR 47, PARA. 15.247(D)

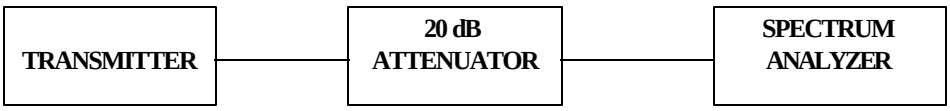
6.11.1. Limits

For New Technology Digital Modulation systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

6.11.2. Method of Measurements

Refer to Exhibit 8, Sec. 8.5 of this test report for detailed measurement procedures

6.11.3. Test Arrangement



6.11.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Hewlett Packard	HP 8593EM	3412A00103	9 kHz – 26.5 GHz

6.11.5. Plots

Refer to Plots # 73 to 84 in Annex 1 for Measurement Plots

6.11.6. Test Data

CHANNEL FREQUENCY (MHz)	MODULATION DATA RATE	RF POWER LEVEL IN 3 KHz BW (dBm)	LIMIT (dBm)	MARGIN (dB)	COMMENTS (PASS/FAIL)
5735	64 QAM (54 Mb/s)	-4.8	8.0	-12.8	PASS
5775	64 QAM (54 Mb/s)	-4.2	8.0	-12.2	PASS
5815	64 QAM (54 Mb/s)	-2.2	8.0	-10.2	PASS
5735	16QAM (36 Mb/s)	-5.3	8.0	-13.3	PASS
5775	16QAM (36 Mb/s)	-4.1	8.0	-12.1	PASS
5815	16QAM (36 Mb/s)	0.0	8.0	-8.0	PASS
5735	QPSK (18 Mb/s)	-3.7	8.0	-11.7	PASS
5775	QPSK (18 Mb/s)	-2.2	8.0	-10.2	PASS
5815	QPSK (18 Mb/s)	-0.8	8.0	-8.8	PASS
5735	BPSK (9 Mb/s)	-4.7	8.0	-12.7	PASS
5775	BPSK (9 Mb/s)	-3.8	8.0	-11.8	PASS
5815	BPSK (9 Mb/s)	-2.8	8.0	-10.8	PASS

6.12. TRANSMITTER BAND-EDGE & SPURIOUS RADIATED EMISSIONS @ 3 METERS, FCC CFR 47, PARA. 15.247(C), 15.209 & 15.205

6.12.1. Limits

In any 100 kHz bandwidth outside the frequency band in which the New Technology Digital Modulation intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Sec. 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Sec. 15.205(a), must also comply with the radiated emission limits specified in Sec. 15.209(a) (see Sec. 15.205(c)).

Remarks:

- Applies to harmonics/spurious emissions that fall in the restricted bands listed in Section 15.205. The maximum permitted average field strength is listed in Section 15.209.
- **@ FCC CFR 47, Para. 15.237(c)** - The emission limits as specified above are based on measurement instrument employing an average detector. The provisions in **@15.35** for limiting peak emissions apply.

FCC CFR 47, Part 15, Subpart C, Para. 15.205(a) - Restricted Frequency Bands

MHz	MHz	MHz	GHz
0.090 - 0.110	162.0125 - 167.17	2310 - 2390	9.3 - 9.5
0.49 – 0.51	167.72 - 173.2	2483.5 - 2500	10.6 - 12.7
2.1735 - 2.1905	240 - 285	2655 - 2900	13.25 - 13.4
8.362 - 8.366	322 - 335.4	3260 - 3267	14.47 - 14.5
13.36 - 13.41	399.9 - 410	3332 - 3339	14.35 - 16.2
25.5 – 25.67	608 - 614	3345.8 - 3358	17.7 - 21.4
37.5 – 38.25	960 - 1240	3600 - 4400	22.01 - 23.12
73 - 75.4	1300 - 1427	4500 - 5250	23.6 - 24.0
108 – 121.94	1435 - 1626.5	5350 - 5460	31.2 - 31.8
123 – 138	1660 - 1710	7250 - 7750	36.43 - 36.5
149.9 – 150.05	1718.8 - 1722.2	8025 - 8500	Above 38.6
156.7 – 156.9	2200 - 2300	9000 - 9200	

FCC CFR 47, Part 15, Subpart C, Para. 15.209(a)
-- Field Strength Limits within Restricted Frequency Bands --

FREQUENCY (MHz)	FIELD STRENGTH LIMITS (microvolts/m)	DISTANCE (Meters)
0.009 - 0.490	2,400 / F (KHz)	300
0.490 - 1.705	24,000 / F (KHz)	30
1.705 - 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 – 960	200	3
Above 960	500	3

6.12.2. Method of Measurements

Refer to Exhibit 8, Sec. 8.5.2 of this test report and **ANSI 63.4-1992, Para. 8** for detailed radiated emissions measurement procedures.

The following measurement procedures were also applied:

- Applies to harmonics/spurious that fall in the restricted bands listed in Section 15.205. the maximum permitted average field strength is listed in Section 15.209. A Pre-Amp and highpass filter are used for this measurement.
- For measurement below 1 GHz, set RBW = 100 KHz, VBW $\geq$ 100 KHz, SWEEP=AUTO.
- For measurement above 1 GHz, set RBW = 1 MHz, VBW = 1 MHz (Peak) & VBW = 10 Hz (Average), SWEEP=AUTO.
- If the emission is pulsed, modified the unit for continuous operation, then use the settings above for measurements, then correct the reading by subtracting the peak-average correction factor derived from the appropriate duty cycle calculation. See Section 15.35(b) and (c).

6.12.3. Test Arrangement

Please refer to Test Arrangement in Sec. 5.5.3 for details of test setup for emission measurements.

6.12.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Advantest	R3271	15050203	100 Hz to 32 GHz with external mixer for frequency above 32 GHz
Microwave Amplifier	Hewlett Packard	HP 83017A		1 GHz to 26.5 GHz
Biconilog Antenna	EMCO	3143	1029	20 MHz to 2 GHz
Horn Antenna	EMCO	3155	9701-5061	1 GHz – 18 GHz
Horn Antenna	EMCO	3160-09	..	18 GHz – 26.5 GHz
Horn Antenna	EMCO	3160-10	..	26.5 GHz – 40 GHz
Mixer	Tektronix	118-0098-00	..	18 GHz – 26.5 GHz
Mixer	Tektronix	119-0098-00	..	26.5 GHz – 40 GHz

6.12.5. Plots

The following plots graphically represent the test results recorded in the above Test Data Table.

6.12.6. Photographs of Test Setup

Refer to the Photographs #3 & #21 in Annex 2 for setup and arrangement of equipment under tests and its ancillary equipment.

6.12.7. Test Data

6.12.7.1. Band-edge Radiated Emissions at 3 meters

6.12.7.1.1. For Point to Multipoint application

Please refer to Plots # 85 to 156 in Annex 1 for the Band-edge emissions measurements of the AN50S with ALL different antennas at their maximum rf output powers rated for Point-to-Multipoint application. The modulation 64QAM (54 Mb/s) is tested and represent for other modulations; band-edge emissions were scanned for other modulations, and the results were found to be the same for all.

Band-edge Emission Plot Numbers in Annex 1	Photos of Test Setup In Annex 2	Channel Frequency (MHz)	Supplier's Antenna Part Number	Redline's Part Number	Antenna Gain (dBi)	Antenna Type	Maker	Maximum RF Conducted Output Power (dBm)
85 to 92	3 & 4	5735, 5775, 5795 & 5815	484025	10-0007	14.0	Omni-directional	MTI Wireless Edge	21.33
93 to 100	5 & 6	5735, 5775, 5795 & 5815	484026	10-0006	15.0	Omni-directional	MTI Wireless Edge	19.96
101 to 108	7 & 8	5735, 5775, 5795 & 5815	485002	10-0004	23.0	Directional	MTI Wireless Edge	12.74
109 to 116	9 & 10	5735, 5775, 5795 & 5815	486001	10-0003	28.0	Directional	MTI Wireless Edge	7.71
117 to 124	11 & 12	5735, 5775, 5795 & 5815	SP1-5.2NS	10-0058	22.5	Directional	Radiowaves	12.74
125 to 132	13 & 14	5735, 5775, 5795 & 5815	SP2-5.2NS	10-0057	29.0	Directional	Radiowaves	6.33
133 to 140	15 & 16	5735, 5775, 5795 & 5815	SP3-5.2NS	10-0059	31.2	Directional	Radiowaves	4.15
141 to 148	17 & 18	5735, 5775, 5795 & 5815	MPR58029PTNF	10-0068	29.0	Directional	MaxRad	6.33
149 to 156	19 & 20	5735, 5775, 5795 & 5815	MPR68031PTNF	10-0069	31.0	Directional	MaxRad	4.15

6.12.7.1.2. For Point to Point application

Please refer to Plots # 157 to 180 in Annex 1 for the Band-edge emissions measured with maximum gain antenna within its family. Maximum rf output powers rated (26.03 dBm) for Point-to-Point application was set for measurements. The modulation 64QAM (54 Mb/s) is tested and represent for other modulations; band-edge emissions were scanned for other modulations, and the results were found to be the same for all.

Band-edge Emission Plot Numbers in Annex 1	Photos of Test Setup In Annex 2	Channel Frequency (MHz)	Supplier's Antenna Part Number	Redline's Antenna Part Number	Antenna Gain (dBi)	Antenna Type	Maker	Maximum RF Conducted Output Power (dBm)
157 to 164	9 & 10	5735, 5775, 5795 & 5815	486001	10-0003	28.0	Directional	MTI Wireless Edge	26.03
165 to 172	15 & 16	5735, 5775, 5795 & 5815	SP3-5.2NS	10-0059	31.2	Directional	Radiowaves	26.03
173 to 180	19 & 20	5735, 5775, 5795 & 5815	MPR68031PTNF	10-0069	31.0	Directional	MaxRad	26.03

Remarks for Spurious/Harmonic Radiated Emissions Measurements:

Based on the test results for Conducted rf output power measurements & Conducted band-edge & spurious emissions:

(1) The emissions are identical with different modulations; therefore, test with 64QAM will be selected for radiated tests and the results shall be used to represent for other modulations.
(2) The maximum rf output power is the worst case that is tested for radiated emissions.
(3) The antenna with the highest gain among the each family will be tested for the worst case :

(a) MTI Antenna Model 486001, Gain: 28 dBi
(b) Radiowave Antenna Model SP3-5.2NS, Gain: 31.2 dBi
(c) MaxRad Antenna Model MPR68031PTNF, Gain: 31.0 dBi

6.12.7.2. Transmitter Radiated Emissions with MTI Antenna Model 486001, Gain: 28 dBi (maximum gain within its family)

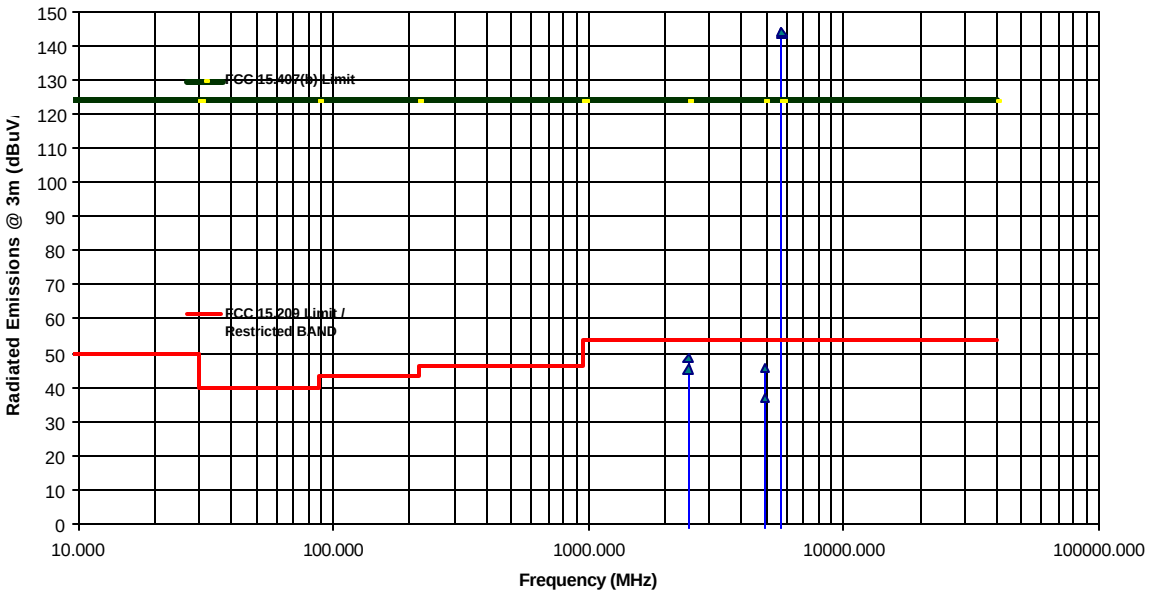
*** Refer to Photos # 9 & 10 in Annex 2 for detailed of test setup.

6.12.7.2.1. Channel #1, Frequency: 5735 MHz, Output power: 24.56 dBm, Modulation: 64QAM

FREQUENCY (MHz)	RF PEAK LEVEL @ 3m (dBuV/m)	RF AVG LEVEL @3m (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2460.00	51.6	48.5	V	54.0	123.9	-75.4	PASS
2460.00	59.5	45.4	H	54.0	123.9	-78.5	PASS
4920.00	52.0	45.8	V	54.0	123.9	-8.2	* PASS
4920.00	48.5	37.0	H	54.0	123.9	-17.0	* PASS
5735.00	143.7	--	V	--	--	--	--
5735.00	143.9	--	H	--	--	--	--

- The emissions were scanned from 10 MHz to 40 GHz and all emissions less 20 dB below the limits were recorded.
- * emissions that fall in the restricted band

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
Redline Comnunications Inc.
Access Node, Model AN-50 with MTI Model MT-486001 Antenna (Gain: 28 dBI , directional)
Tx Freq.: 5.735 GHz, RF Ouptut Power: 24.56 dBm, Modulation: 64QAM (54 Mb/s)

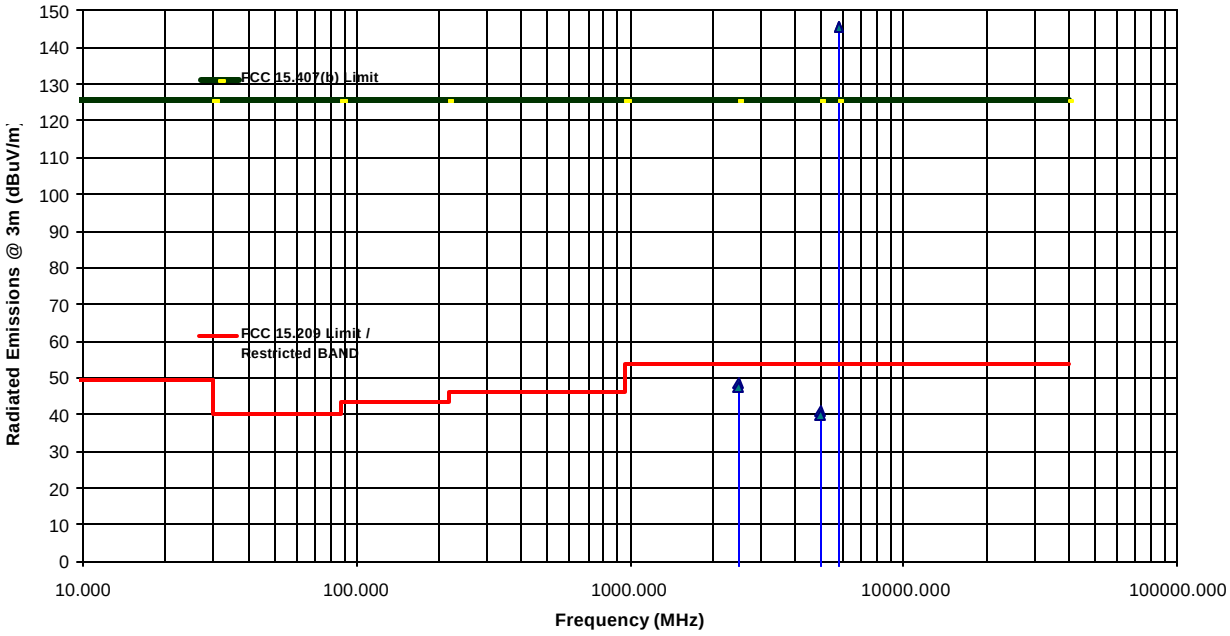


6.12.7.2.2. Channel #3, Frequency: 5775 MHz, Output power: 25.44 dBm, Modulation: 64QAM

FREQUENCY (MHz)	RF PEAK LEVEL @ 3m (dBuV/m)	RF AVG LEVEL @3m (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2480.00	51.0	48.5	V	54.0	125.5	-77.0	PASS
2480.00	51.7	47.6	H	54.0	125.5	-77.9	PASS
4960.00	49.4	41.1	V	54.0	125.5	-12.9	PASS *
4960.00	49.2	39.7	H	54.0	125.5	-14.3	PASS *
5775.00	145.5	--	V	--	--	--	--
5775.00	145.5	--	H	--	--	--	--

- The emissions were scanned from 10 MHz to 40 GHz and all emissions less 20 dB below the limits were recorded.
- * emissions that fall in the restricted band

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
Redline Comnunications Inc.
Access Node, Model AN-50 with MTI Model MT-486001 Antenna (Gain: 28 dBI , directional)
Tx Freq.: 5.775 GHz, RF Ouptut Power: 25.44 dBm, Modulation: 64QAM (54 Mb/s)

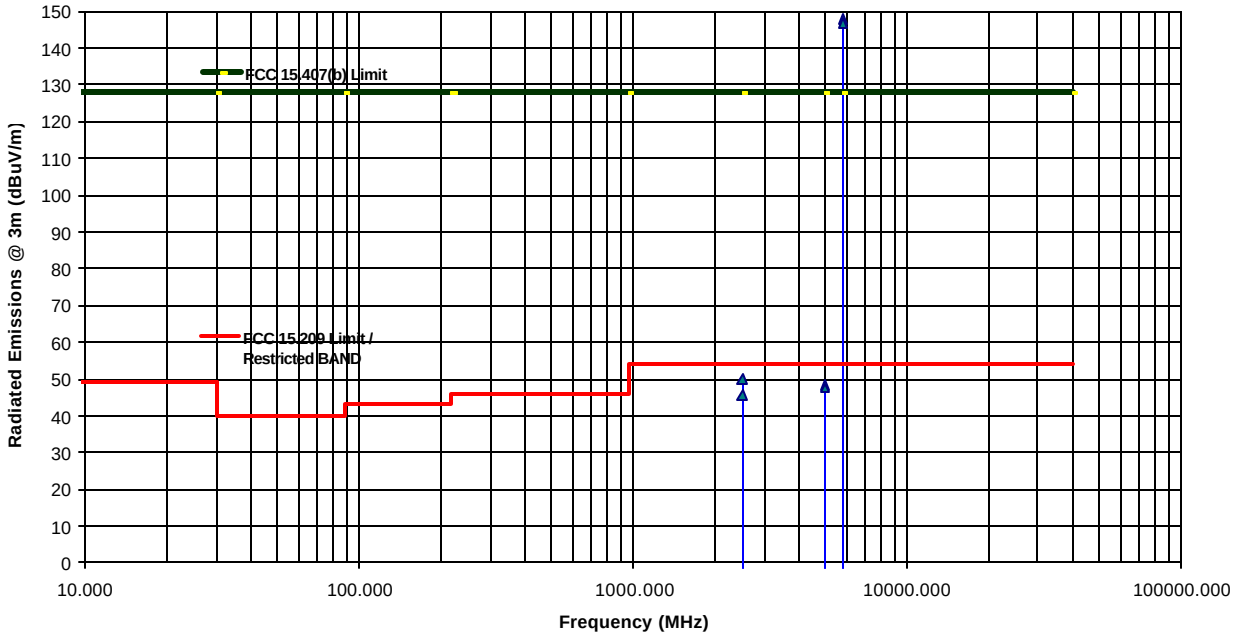


6.12.7.2.3. Channel #5, Frequency: 5815 MHz, Output power: 26.03 dBm, Modulation: 64QAM

FREQUENCY (MHz)	RF PEAK LEVEL @ 3m (dBuV/m)	RF AVG LEVEL @3m (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2500.00	52.6	49.9	V	54.0	127.8	-4.1	PASS *
2500.00	49.6	45.5	H	54.0	127.8	-8.5	PASS *
5000.00	53.4	48.5	V	54.0	127.8	-5.5	PASS *
5000.00	53.6	47.6	H	54.0	127.8	-6.4	PASS *
5815.00	147.8	--	V	--	--	--	--
5815.00	146.8	--	H	--	--	--	--

- The emissions were scanned from 10 MHz to 40 GHz and all emissions less 20 dB below the limits were recorded.
- * emissions that fall in the restricted band

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
Redline Comnunications Inc.
Access Node, Model AN-50 with MTI Model MT-486001 Antenna (Gain: 28 dBi , directional)
Tx Freq.: 5.815 GHz, RF Ouptut Power: 26.03 dBm, Modulation: 64QAM (54 Mb/s)



6.12.7.3. Transmitter Radiated Emissions with Radiowave Antenna Model SP3-5.2NS, Gain: 31.2 dBi (maximum gain within its family)

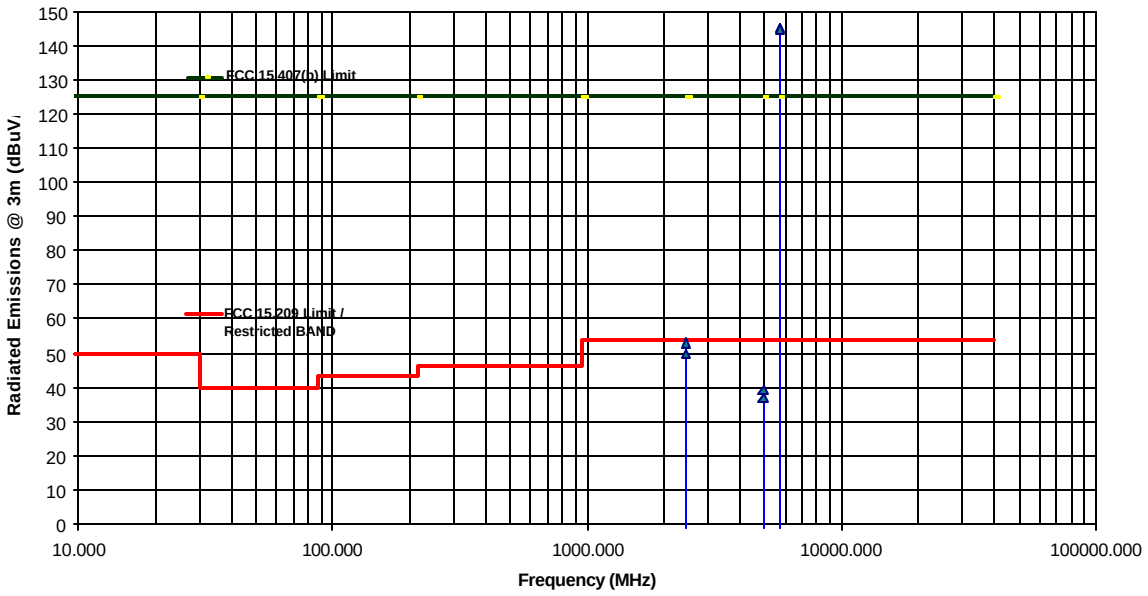
*** Refer to Photos # 15 & 16 in Annex 2 for detailed of test setup.

6.12.7.3.1. Channel #1, Frequency: 5735 MHz, Output power: 24.56 dBm, Modulation: 64QAM

FREQUENCY (MHz)	RF PEAK LEVEL @ 3m (dBuV/m)	RF AVG LEVEL @3m (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2460.00	54.5	52.9	V	54.0	125.1	-72.2	PASS
2460.00	52.5	49.7	H	54.0	125.1	-75.4	PASS
4920.00	47.3	39.3	V	54.0	125.1	-14.8	PASS*
4920.00	49.4	37.0	H	54.0	125.1	-17.0	PASS*
5735.00	145.1	--	V	--	--	--	--
5735.00	144.9	--	H	--	--	--	--

- The emissions were scanned from 10 MHz to 40 GHz and all emissions less 20 dB below the limits were recorded.
- * emissions that fall in the restricted band

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
Redline Comnunications Inc.
Model AN-50 with Radiowave Model SP1-5GHz Antenna (Gain: 31.2dBi , directional)
Tx Freq.: 5.735 GHz, RF Ouptut Power: 24.56 dBm, Modulation: 64QAM (54 Mb/s)

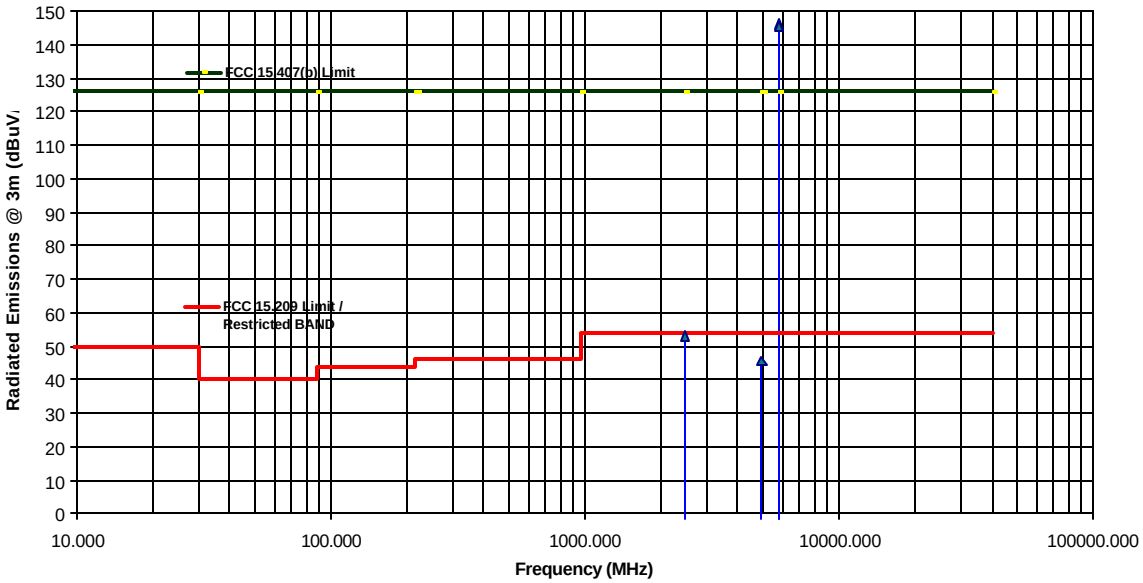


6.12.7.3.2. Channel #3, Frequency: 5775 MHz, Output power: 25.44 dBm, Modulation: 64QAM

FREQUENCY (MHz)	RF PEAK LEVEL @ 3m (dBuV/m)	RF AVG LEVEL @3m (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2480.00	55.6	53.1	V	54.0	126.1	-73.0	PASS
4960.00	52.1	45.6	V	54.0	126.1	-8.4	PASS *
5775.00	146.1	--	V	--	--	--	--
5775.00	145.5	--	H	--	--	--	--

- The emissions were scanned from 10 MHz to 40 GHz and all emissions less 20 dB below the limits were recorded.
- * emissions that fall in the restricted band

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
Redline Comnunications Inc.
Model AN-50 with Radiowave Model SP1-5GHz Antenna (Gain: 31.2dBi , directional)
Tx Freq.: 5.775 GHz, RF Ouptut Power: 25.44 dBm, Modulation: 64QAM (54 Mb/s)

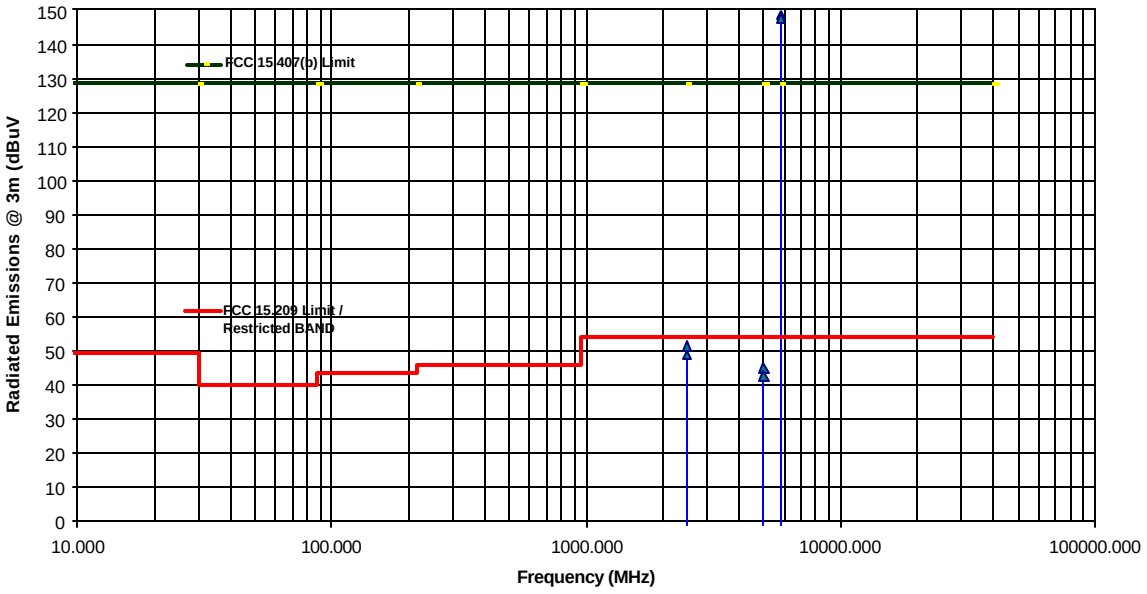


6.12.7.3.3. Channel #5, Frequency: 5815 MHz, Output power: 26.03 dBm, Modulation: 64QAM

FREQUENCY (MHz)	RF PEAK LEVEL @ 3m (dBuV/m)	RF AVG LEVEL @3m (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2500.00	54.0	51.4	V	54.0	128.5	-2.6	PASS *
2500.00	52.0	48.6	H	54.0	128.5	-5.4	PASS *
5000.00	52.0	45.0	V	54.0	128.5	-9.0	PASS *
5000.00	51.3	42.5	H	54.0	128.5	-11.5	PASS *
5815.00	148.5	--	V	--	--	--	--
5815.00	147.6	--	H	--	--	--	--

- The emissions were scanned from 10 MHz to 40 GHz and all emissions less 20 dB below the limits were recorded.
- * emissions that fall in the restricted band

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
Redline Comnunications Inc.
Model AN-50 with Radiowave Model SP1-5GHz Antenna (Gain: 31.2 dBi , directional)
Tx Freq.: 5.815 GHz, RF Ouptut Power: 26.03 dBm, Modulation: 64QAM (54 Mb/s)



6.12.7.4. Transmitter Radiated Emissions with MaxRad Antenna Model MPR68031PTNF, Gain: 31.0 dBi (maximum gain within its family)

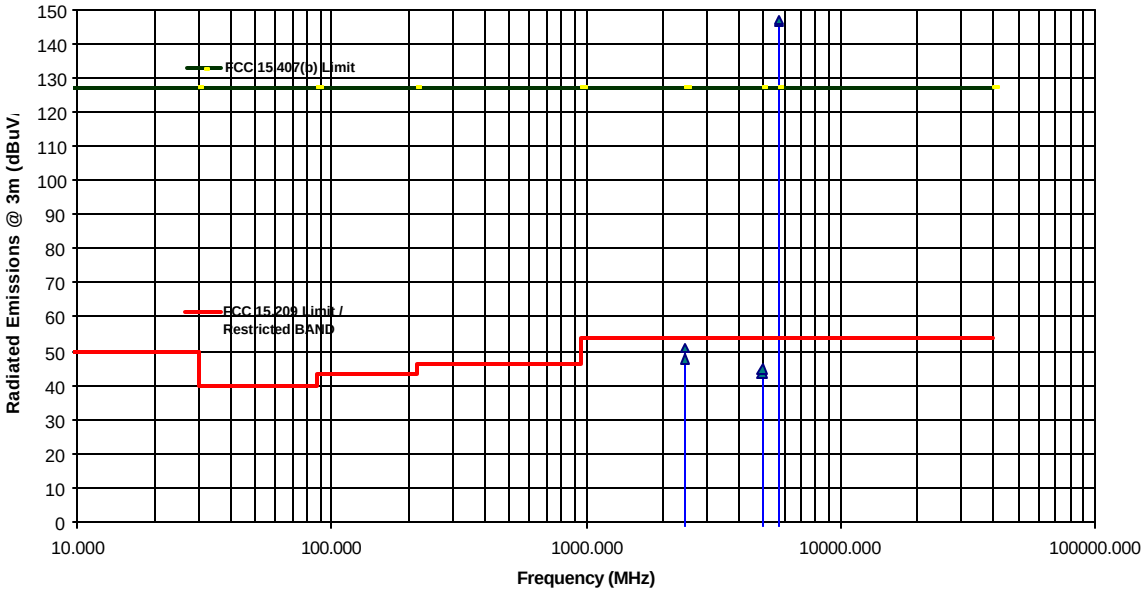
*** Refer to Photos # 19 & 20 in Annex 2 for detailed of test setup.

6.12.7.4.1. Channel #1, Frequency: 5735 MHz, Output power: 24.56 dBm, Modulation: 64QAM

FREQUENCY (MHz)	RF PEAK LEVEL @ 3m (dBuV/m)	RF AVG LEVEL @3m (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2460.00	53.3	51.0	V	54.0	127.1	-76.1	PASS
2460.00	50.9	47.7	H	54.0	127.1	-79.4	PASS
4920.00	48.7	43.5	V	54.0	127.1	-10.5	PASS*
4920.00	51.6	44.7	H	54.0	127.1	-9.3	PASS*
5735.00	146.3	--	V	--	--	--	--
5735.00	147.1	--	H	--	--	--	--

- The emissions were scanned from 10 MHz to 40 GHz and all emissions less 20 dB below the limits were recorded.
- * emissions that fall in the restricted band

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
Redline Comnunications Inc.
Model AN-50 with MaxRad Model MPR68031PTNF Antenna (Gain: 31 dBi , directional)
Tx Freq.: 5.735 GHz, RF Ouptut Power: 24.56 dBm, Modulation: 64QAM (54 Mb/s)

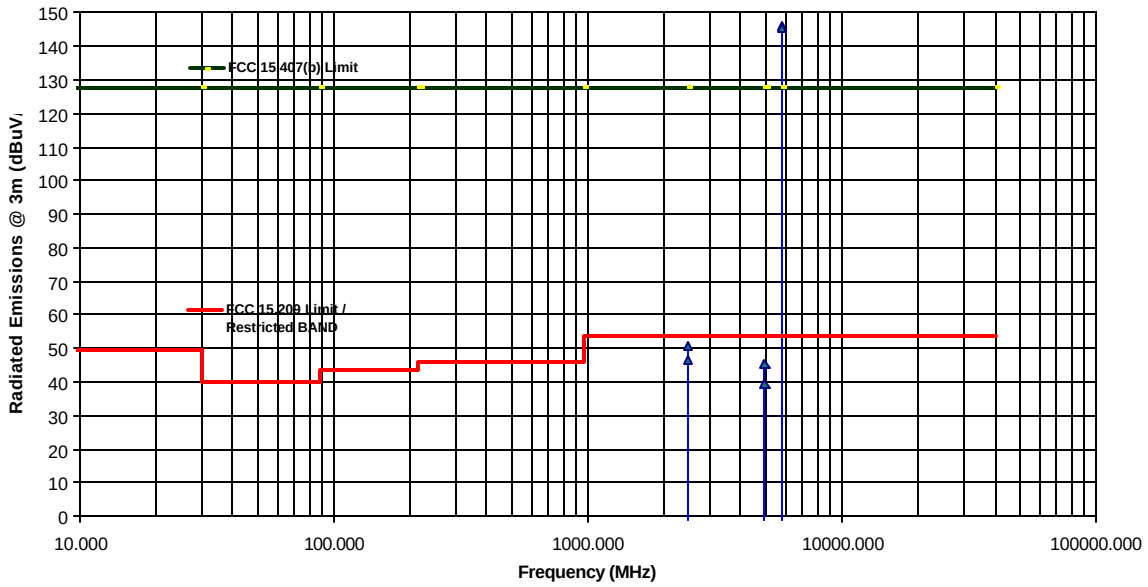


6.12.7.4.2. Channel #3, Frequency: 5775 MHz, Output power: 25.44 dBm, Modulation: 64QAM

FREQUENCY (MHz)	RF PEAK LEVEL @ 3m (dBuV/m)	RF AVG LEVEL @3m (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2480.00	52.8	50.7	V	54.0	127.8	-77.1	PASS
2480.00	52.9	46.6	H	54.0	127.8	-81.2	PASS
4960.00	49.2	39.3	V	54.0	127.8	-14.7	PASS *
4960.00	51.9	45.3	H	54.0	127.8	-8.7	PASS *
5775.00	146.5	--	V	--	--	--	--
5775.00	147.8	--	H	--	--	--	--

- The emissions were scanned from 10 MHz to 40 GHz and all emissions less 20 dB below the limits were recorded.
- * emissions that fall in the restricted band

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
Redline Comnunications Inc.
Model AN-50 with Radiowave Model SP1-5GHz Antenna (Gain: 31.dBi , directional
Tx Freq.: 5.775 GHz, RF Ouptut Power: 25.44 dBm, Modulation: 64QAM (54 Mb/s)



6.12.7.4.3. Channel #5, Frequency: 5815 MHz, Output power: 26.03 dBm, Modulation: 64QAM

FREQUENCY (MHz)	RF PEAK LEVEL @ 3m (dBuV/m)	RF AVG LEVEL @3m (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2500.00	53.3	50.6	V	54.0	129.5	-3.4	PASS *
2500.00	52.3	49.8	H	54.0	129.5	-4.2	PASS *
5000.00	52.4	44.9	V	54.0	129.5	-9.1	PASS *
5000.00	50.8	41.7	H	54.0	129.5	-12.3	PASS *
148.2	148.2	--	V	--	--	--	--
149.5	149.5	--	H	--	--	--	--

- The emissions were scanned from 10 MHz to 40 GHz and all emissions less 20 dB below the limits were recorded.
- * emissions that fall in the restricted band

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
Redline Comnunications Inc.
Model AN-50 with MaxRad Model MPR68031PTNF Antenna (Gain: 31 dBi , directional)
Tx Freq.: 5.815 GHz, RF Ouptut Power: 26.03 dBm, Modulation: 64QAM (54 Mb/s)

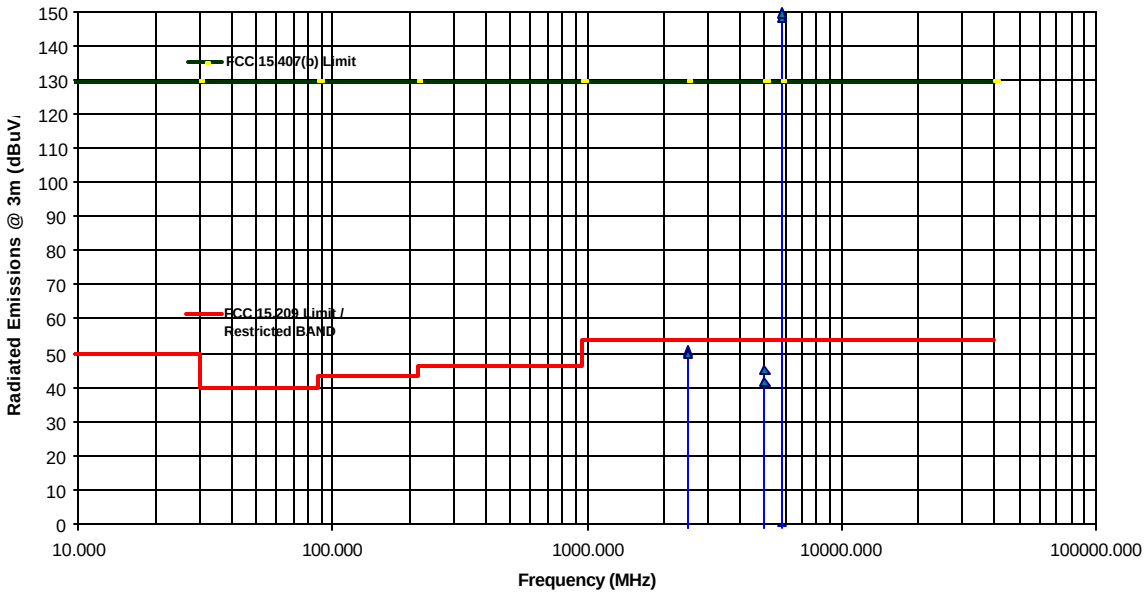


EXHIBIT 7. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and NIS 81 (1994)

7.1. LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Line Conducted)	PROBABILITY DISTRIBUTION	UNCERTAINTY (dB)	
		9-150 kHz	0.15-30 MHz
EMI Receiver specification	Rectangular	±1.5	±1.5
LISN coupling specification	Rectangular	±1.5	±1.5
Cable and Input Transient Limiter calibration	Normal (k=2)	±0.3	±0.5
Mismatch: Receiver VRC Γ_1 = 0.03 LISN VRC Γ_R = 0.8(9 kHz) 0.2 (30 MHz) Uncertainty limits 20Log(1±$\Gamma_1\Gamma_R$)	U-Shaped	±0.2	±0.3
System repeatability	Std. deviation	±0.2	±0.05
Repeatability of EUT	--	--	--
Combined standard uncertainty	Normal	±1.25	±1.30
Expanded uncertainty U	Normal (k=2)	±2.50	±2.60

Sample Calculation for Measurement Accuracy in 450 kHz to 30 MHz Band:

$$u_c(y) = \sqrt{\sum_{I=1}^{m} u_i^2(y)} = \pm \sqrt{(1.5^2 + 1.5^2)/3 + (0.5/2)^2 + (0.05/2)^2 + 0.35^2} = \pm 1.30 \text{ dB}$$

$$U = 2u_c(y) = \pm 2.6 \text{ dB}$$

7.2. RADIATED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Radiated Emissions)	PROBABILITY DISTRIBUTION	UNCERTAINTY (± dB)	
		3 m	10 m
Antenna Factor Calibration	Normal (k=2)	±1.0	±1.0
Cable Loss Calibration	Normal (k=2)	±0.3	±0.5
EMI Receiver specification	Rectangular	±1.5	±1.5
Antenna Directivit	Rectangular	+0.5	+0.5
Antenna factor variation with height	Rectangular	±2.0	±0.5
Antenna phase center variation	Rectangular	0.0	±0.2
Antenna factor frequency interpolation	Rectangular	±0.25	±0.25
Measurement distance variation	Rectangular	±0.6	±0.4
Site imperfections	Rectangular	±2.0	±2.0
Mismatch: Receiver VRC $\Gamma_1 = 0.2$ Antenna VRC $\Gamma_R = 0.67$(Bi) 0.3 (Lp) Uncertainty limits 20Log($1 \pm \Gamma_1\Gamma_R$)	U-Shaped	+1.1 -1.25	±0.5
System repeatability	Std. Deviation	±0.5	±0.5
Repeatability of EUT		-	-
Combined standard uncertainty	Normal	+2.19 / -2.21	+1.74 / -1.72
Expanded uncertainty U	Normal (k=2)	+4.38 / -4.42	+3.48 / -3.44

Calculation for maximum uncertainty when 3m biconical antenna including a factor of k=2 is used:

$U = 2u_c(y) = 2x(+2.19) = +4.38$ dB And $U = 2u_c(y) = 2x(-2.21) = -4.42$ dB

EXHIBIT 8. MEASUREMENT METHODS

8.1. GENERAL TEST CONDITIONS

The following test conditions shall be applied throughout the tests covered in this report.

8.1.1. Normal temperature and humidity

- Normal temperature: +15°C to +35°C
- Relative Humidity: +20% to 75%

The actual values during tests shall be recorded in the test report.

8.1.2. Normal power source

8.1.2.1. Mains Voltage

The nominal test voltage of the equipment to be connected to mains shall be the nominal mains voltage which is the declared voltage or any of the declared voltages for which the equipment was designed.

The frequency of test power source corresponding to the AC mains shall be between 59 Hz and 61 Hz.

8.1.3. Operating Condition of Equipment under Test

- All tests were carried out while the equipment operated at the following frequencies:
  - The lowest operating frequency,
  - The middle operating frequency and
  - The highest operating frequency

- Modulation were applied using the Test Data sequence
- The transmitter was operated at the highest output power, or in the case the equipment able to operate at more than one power level, at the lowest and highest output powers

8.2. TRANSMITTER POWER DENSITY

- The radio was connected to the measuring equipment via a suitable attenuator.
- Locate and zoom in on emission peak(s) within the passband
- The spectrum analyzer were used and set as follows:

  - Resolution BW: 3 kHz
  - Video BW: same or greater
  - Detector Mode: Normal
  - Averaging: Off
  - Span: 3 MHz
  - Amplitude: Adjust for middle of the instrument's range
  - Sweep Time: 1000 seconds

- Locate and zoom in on emission peak(s) within the passband. Set RBW = 3 KHz, VBW $\geq$ RBW, Sweep = SPAN/3 KHz. For example, a span of 1.5 MHz, the sweep should be $1.6x10^6/3.0x10^3$= 500 seconds. The measured peak level must be no greater than +8 dBm.
- For devices with spectrum line spacing greater than 3 KHz no change is required.
- For devices with spectrum line spacing equal to or less than 3 KHz, the resolution bandwidth must be reduced below 3 KHz until the individual lines in the spectrum are resolved. The measurement data must then be normalized to 3 KHz by summing the power of all the individual spectral lines within 3 KHz band (in linear power units) to determine compliance.
- If the spectrum line spacing cannot be resolved on the available spectrum analyzer, the noise density function on most modern conventional spectrum analyzer will directly measure the noise power density normalized to 1 Hz noise power bandwidth. Add 30 dB for correction to 3 KHz.

Should all the above fail or any controversy develop regarding accuracy of measurement, the Laboratory will use HP 89440A Vector Signal Analyzer for final measurement unless a clear showing can be made for a further alternate.

8.3. METHOD OF MEASUREMENTS - AC MAINS CONDUCTED EMISSIONS

- AC Mains conducted emissions measurements were performed in accordance with the standard against appropriate limits for each detector function.
- The test was performed in the shielded room, 16'(L) by 16'(W) by 12'(H).
- The test was performed were made over the frequency range from 450 kHz to 30 MHz to determine the line-to-ground radio noise voltage which was conducted from the EUT power-input terminals that were directly connected to a public power network.
- The EUT normally received power from another device that connects to the public utility ac power lines, measurements would be made on that device with the EUT in operation to ensure that the device continues to comply with the appropriate limits while providing the EUT with power.
- If the EUT operates only from internal or dedicated batteries, with no provisions for connection to the public utility ac power lines, AC Mains conducted measurements are not required.
- Table-top devices were placed on a platform of nominal size 1 m by 1.5m raised 80 cm above the conducting ground plane.
- The EUT current-carrying power lead, except the ground (safety) lead, was individually connected through a LISN to the power source. All unused 50-Ohm connectors of the LISN was terminated in 50-ohm when not connected to the measuring instruments.
- The line cord of the EUT connected to one LISN which was connected to the measuring instrument. Those power cords for the units of devices not under measurement were connected to a separate multiple ac outlet. Drawings and photographs of typically conducted emission test setups were shown in the Test Report. Each current-carrying conductor of the EUT shall be individually tested.
- The EUT was normally operated with a ground (safety) connection, the EUT was connected to the ground at the LISN through a conductor provided in the lead from the ac power mains to the LISN.
- The excess length of the power cord was folded back and forth in an 8-shape on a wooden strip with a vertical prong located on the top of the LISN case.
- The EUT was set-up in its typical configuration and operated in its various modes as described in 3.2 of the test report.
- A preliminary scan was made by using spectrum analyzer system with the detector function set to PEAK mode (9 KHz RBW, VBW > RBW), frequency span 450 kHz to 30 MHz.

- The maximum conducted emission for a given mode of operation was found by using the following step-by-step procedure:

  Step1. Monitor the frequency range of interest at a fixed EUT azimuth.

  Step2. Manipulate the system cables and peripheral devices to produce highest amplitude signal relative to the limit. Note the amplitude and frequency of the suspect signal.

  Step3. The effects of various modes of operation is examined. This is done by varying equipment operation modes as step 2 is being performed.

  Step4. After completing step 1 through 3, record EUT and peripheral device configuration, mode of operation, cable configuration, signal levels and frequencies for final test.

- Each highest signal level at the maximized test configuration was zoomed in a small frequency span on the spectrum analyzer's display (the manipulation of cables and peripheral devices and EUT operation modes might have to be repeated to obtain the highest signal level with the spectrum analyzer set to PEAK detector mode 10 KHz RBW and VBW > RBW). The spectrum analyzer was then set to CISPR QUASI-PEAK detector mode (9 KHz RBW, 1 MHz

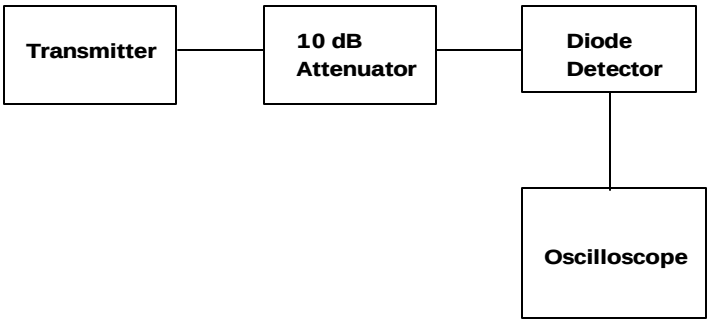
VBW) and AVERAGE detector mode (10 kHz RBW, 1 Hz VBW). The final highest RF signal levels and frequencies were record.

8.4. PEAK CONDUCTED TRANSMIT POWER

Test procedure shall be as follows:

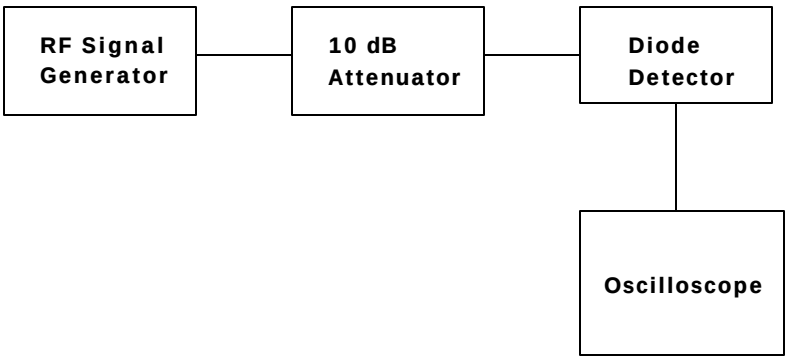
Step 1:

- Connect the transmitter output to a diode detector through an attenuator
- Connect the diode detector to the vertical channel of an oscilloscope.
- The observed duty cycle of the transmitter, x = Tx on / (Tx on + Tx off) with 0<x<1, is measure and recorded in the test report. For the purpose of testing, the equipment shall be operated with a duty cycle that is equal or more than 0.1.
- Observe and record the y parameter of the DC level on the oscilloscope.



Step 2: Peak Power Measurements

- Replace the transmitter by a RF signal generator
- Set the signal generator frequency be the same as the transmitter frequency
- Adjust the rf output level of the RF signal generator until the DC level on the oscilloscope is same as that (y) recorded in step 1.
- Measure the RF signal generator output level using a power meter
- Calculate the total peak power (Pp) by adding the signal generator level with the attenuator value and the cable loss.



8.5. SPURIOUS EMISSIONS (CONDUCTED & RADIATED)

For both conducted and radiated measurements, the spurious emissions were scanned from the lowest frequency generated by the EUT or 10 MHz whichever is lower to 10th harmonic of the highest frequency generated by the EUT.

8.5.1. Band-edge and Spurious Emissions (Conducted)

Band-edge Compliance of RF Conducted Emissions:

Use the following spectrum analyzer settings:

- The radio was connected to the measuring equipment via a suitable attenuator.
- Span = wide enough to capture the peak level of the emission operating on the channel closest to the band-edge, as well as any modulation products which fall outside of the authorized band of operation.
- RBW = 1 % of the span
- VBW = RBW
- Sweep = auto
- Detector function = peak
- Trace = max hold
- Allow the trace to stabilize
- Set the marker on the emission at the band-edge, or on the highest modulation product outside of the band, if this level is greater than that at the band-edge
- Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission.
- The marker-delta value now displayed must comply with the limit specified
- Submit this plot

Spurious RF Conducted Emissions:

Use the following spectrum analyzer settings:

- The radio was connected to the measuring equipment via a suitable attenuator.
- Span = wide enough to capture the peak level of the in-band-emission and all spurious emissions (e.g. harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, sevral plots are required to cover this entire span.
- RBW = 100 kHz
- VBW = RBW
- Sweep = auto
- Detector function = peak
- Trace = max hold
- Allow the trace to stabilize
- Set the marker on the any spurious emission recorded. The level displayed must comply with the limit specified in this Section.
- Submit this plot

8.5.2. Spurious Emissions (Radiated)

- The radiated emission measurements were performed at the UltraTech's 3 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario. The Attenuation Characteristics of OFTS have been filed to FCC, Industry Canada, ACA/Austel, NVLap and ITI.

- Radiated emissions measurements were made using the following test instruments:

1. Calibrated EMCO BiconiLog antenna in the frequency range from 30 MHz to 2000 MHz.
2. Calibrated Emco Horn antennas in the frequency range above 1000 MHz (1GHz - 40 GHz).
3. The test is required for any spurious emission or modulation product that falls in a Restricted Band, as defined in Section 15.205. It must be performed with the highest gain of each type of antenna proposed for use with the EUT. Use the following spectrum analyzer settings:

   - RBW = 100 kHz for f < 1GHz and RBW = 1 MHz for f ≥ 1 GHz
   - VBW = RBW
   - Sweep = auto
   - Detector function = peak
   - Trace = max hold
   - Follows the guidelines in ANSI C63.4-1992 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization, etc.. A pre-amp and highpass filter are required for this test, in order to provide the measuring system with sufficient sensitivity.
   - Allow the trace to stabilize.
   - The peak reading of the emission, after being corrected by the antenna correction factor, cable loss, pre-amp gain, etc…. is the peak field strength which comply with the limit specified in Section 15.35(b)

   Calculation of Field Strength:

   The field strength is calculated by adding the calibrated antenna factor and cable factor, and subtracting the Amplifier gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where FS = Field Strength
RA = Receiver/Analyzer Reading
AF = Antenna Factor
CF = Cable Attenuation Factor
AG = Amplifier Gain

Example: If a receiver reading of 60.0 dBuV is obtained, the antenna factor of 7.0 dB/m and cable factor of 1.0 dB are added, and the amplifier gain of 30 dB is subtracted. The actual field strength will be:
Field Level = 60 + 7.0 + 1.0 - 30 = 38.0 dBuV/m.
Field Level = $10^{(38/20)}$ = 79.43 uV/m.

   - Submit this test data
   - Now set the VBW to 10Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the dwell time of the each channel is less than 100ms, then the reading obtained may be further adjusted by a "duty cycle correction factor", derived from 10log(dwell time/100mS) in an effort to demonstrate compliance with the 15.209.
   - Submit test data

Maximizing The Radiated Emissions:

- The frequencies of emissions was first detected. Then the amplitude of the emissions was measured at the specified measurement distance using required antenna height, polarization, and detector characteristics.
- During this process, cables and peripheral devices were manipulated within the range of likely configuration.
- For each mode of operation required to be tested, the frequency spectrum was monitored. Variations in antenna heights (from 1 meter to 4 meters above the ground plane), antenna polarization (horizontal plane and vertical plane), cable placement and peripheral placement were explored to produce the highest amplitude signal relative to the limit.

The maximum radiated emission for a given mode of operation was found by using the following step-by-step procedure:

Step1: Monitor the frequency range of interest at a fixed antenna height and EUT azimuth.

Step2: Manipulate the system cables to produce highest amplitude signal relative to the limit. Note the amplitude and frequency of the suspect signal.

Step3: Rotate the EUT 360 degrees to maximize the suspected highest amplitude signal. If the signal or another at a different frequency is observed to exceed the previously noted highest amplitude signal by 1 dB or more, go back to the azimuth and repeat Step 2. Otherwise, orient the EUT azimuth to repeat the highest amplitude observation and proceed.

Step4: Move the antenna over its full allowable range of travel (1 to 4 meters) to maximize the suspected highest amplitude signal. If the signal or another at a different frequency is observed to exceed the previously noted highest amplitude signal by 1 dB or more, return to Step 2 with the highest amplitude observation and proceed.

Step5: Change the polarization of the antenna and repeat Step 2 through 4. Compare the resulting suspected highest amplitude signal with that found for the other polarization. Select and note the higher of the two signals. This signal is termed the highest observed signal with respect to the limit for this EUT operational mode.

Step6: The effects of various modes of operation is examined. This is done by varying the equipment modes as steps 2 through 5 are being performed.

Step7: After completing steps 1 through 6, record the final highest emission level, frequency, antenna polarization and detector mode of the measuring instrument.