Simultaneous Transmit of Co-located Transmitters

Applicant: ITRONIX, Corporation

FCC ID: KBCIX300AC555WLBT

Model: IX300

FCC REQUIREMENT FOR SIMULTANEOUS TRANSMISSION

Excerpt below from TCB Question 7 for FCC, FCC / TCB Workshop 10-23-02 Day 2.

"The radios must be tested individually. Assuming that the radios do not share an antenna, only radiated tests for simultaneous transmission is required. If the radios share an antenna, antenna conducted measurements would also be required. Only one set of worst case simultaneous transmission data is going to be requested to be submitted at this time. The test engineer should indicate the worst case condition and provide justification as to why the worst case condition was chosen. The grantee should be reminded that even if the FCC requests one set of data, they are responsible for compliance for all modes of simultaneous transmission.

Aggregate power must be considered in RF exposure evaluation."

DISCUSSION:

The IX300 contains a Sierra Wireless AirCard 555, is a dual band radio with Cellular and PCS transmitter co-located with an 802.11, WLAN, and a FHSS Bluetooth Intentional Radiator. The three radios can transmit simultaneously. Therefore, while simultaneously transmitting the spurious emissions from the above referenced device were compared to the Part 22.917(e) and the 24.238(a) limits for the transmitter and to the Part 15.247(c) limit for the Bluetooth Intentional Radiators. The radios do not share antenna. The AirCard 555 has it's own external antenna. Both Intentional Radiators have their own antenna internally integrated within the IX300 terminal.

Initially measurements were made with the AC555 and WLAN and Bluetooth simultaneously transmitting on there respective low, mid and high channels. Then measurements were made with the WLAN and Bluetooth simultaneously transmitting on the same low, mid, and high RF channels, as well as the AC555 transmitting on it's low mid and high channel. The final measurement results are reported on pages 3 to 6 following.

Additionally, the various channel combinations for the PCS bands used by the GPRS transmitter and the WAN and Bluetooth Intentional Radiator channels were mathematically compared for any harmonic frequency combinations that happen to fall on exactly the same frequency. Additional measurements were made on these specific channel combinations to investigate the possibility of increased emission level with the simultaneous transmit. We expect that the likelihood of
a increase in the harmonic emission level would exist when the combined harmonic energy from two sources is present on the same frequency.

It appears that this situation could occur with at least the following two frequency combinations noted below. In this case however, levels are too low to be measurable.

WAN & Bluetooth set to 2412 MHz (7^{th} harmonic),
with the PCS set to 1876 MHz (9^{th} harmonic)

16844 MHz — No emission was measurable at one half meter EUT to antenna distance, more than 20 below the 15.247 (c) limit.

WAN & Bluetooth set to 2437 MHz (7^{th} harmonic),
With the PCS set to 1896 MHz (9^{th} harmonic)

17066 MHz — No emission was measurable at one half meter EUT to antenna distance, more than 20 below the 15.247 (c) limit.

The following three pages report the other simultaneous transmission emissions findings discussed previously on page one.

Pages 3 & 4.)

Simultaneous Test Frequencies:	**Bluetooth**	**2412, 2437, & 2462 MHz**
Part 15.247(c)	**WAN**	**2412, 2437, & 2462 MHz**
	PCS band	**1850.2, 1880, & 1909.8 MHz**

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Simultaneous Test Frequencies:	**Cell band**	**825.25, 836.50, & 847.75 MHz**
Part 22.917(e)	**Bluetooth**	**2412, 2437, & 2462 MHz**
	WAN	**2412, 2437, & 2462 MHz**

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Simultaneous Test Frequencies:	**PCS band**	**1850.2, 1880, & 1909.8 MHz**
Part 24.238(b & c)	**Bluetooth**	**2412, 2437, & 2462 MHz**
	WAN	**2412, 2437, & 2462 MHz**

EXHIBIT 6G TEST: FIELD STRENGTH OF SPURIOUS RADIATION EMISSIONS

FCC ID:	KBCIX300AC555WLBT
Applicant:	ITRONIX Corp.
Model:	IX300 with Aircard 555 WLAN, & Bluetooth
Minimum Standard Specified:	Part 15.247(c)
Test Results:	Equipment complies with standard
Authorization Procedure:	Part 2.1053
Test Equipment Set Up:	See Block Diagram in Exhibit 7 Date: 3/02/04
Frequency Range Observed:	0 to 25 Ghz

NOTE: Simultaneous co-location transmit on the identical RF channels with the WM168b-Moles WLAN and the Bluetooth transmitter. All transmitters @ High Power

RADIATED HARMONIC AND SPURIOUS EMISSIONS & RESTRICTED BANDS									
Frequency GHz	**Max. SA Rdg. dBu/V**	**Ant. Vert. or Horz.**	**Peak or Average Detector**	**Antenna Factor dB**	**Cable & filter loss dB**	**Amp Gain**	**Corrected Reading dBuV/m**	**Limit 74 Peak 54 Avg dBu/V**	**Margin in dB below LIMIT**
Fo - 2.412									
4.824	32.18	V	Peak	32.45	3.97	23.2	45.40	74	28.60
4.824	27.55	V	Average	32.45	3.97	23.2	40.77	54	13.23
7.236	34.76	V	Peak	36.77	3.42	25.9	49.05	74	24.95
7.236	28.51	V	Average	36.77	3.42	25.9	42.80	54	11.20
9.648	33.93	V	Peak	37.55	4.86	24.5	51.84	74	22.16
9.648	27.74	V	Average	37.55	4.86	24.5	45.65	54	8.35
Fo – 2.437									
4.874	36.48	V	Peak	32.45	3.97	23.2	49.70	74	24.30
4.874	26.24	V	Average	32.45	3.97	23.2	39.46	54	14.54
7.311	39.06	V	Peak	36.77	3.42	25.9	53.35	74	20.65
7.311	26.64	V	Average	36.77	3.42	25.9	40.93	54	13.07
9.746	38.30	V	Peak	37.55	4.86	24.7	56.01	74	17.99
9.746	26.34	V	Average	37.55	4.86	24.7	44.05	54	9.95
Fo – 2.462									
4.924	33.32	V	Peak	32.45	3.97	23.2	46.54	74	27.14
4.924	20.55	V	Average	32.45	3.97	23.2	33.77	54	20.23
7.386	33.21	V	Peak	36.77	3.42	25.9	47.50	74	26.50
7.386	22.15	V	Average	36.77	3.42	25.9	36.44	54	17.56
9.848	31.73	V	Peak	37.55	4.86	24.7	49.44	74	24.56
9.848	21.13	V	Average	37.55	4.86	24.7	38.84	54	15.16

Harmonic emissions on all three channels (low, mid & high) 5Fo – 10Fo at or below noise floor

Channel	**Frequency in GHz**	**Harmonics Observed**	**Limit 74 dBuV/m Peak & 54 dBuV/m Average**
Low Ch.	2.412		
5Fo – 10Fo	12.060 – 24.120	None -at or < noise floor @3m	All emissions < 54 dBuV/m
Mid Ch.	2.441		
5Fo – 10Fo	12.205 – 24.410	None -at or < noise floor @3m	All emissions < 54 dBuV/m
High Ch.	2.480		
5Fo - 10Fo	12.400 – 24.800	None -at or < noise floor @3m	All emissions < 54 dBuV/m

EXHIBIT 6G TEST: FIELD STRENGTH OF SPURIOUS RADIATION EMISSIONS

FCC ID:	KBCIX300AC555WLBT
Applicant:	ITRONIX Corp.
Model:	IX300 with Aircard 555 WLAN, & Bluetooth
Minimum Standard Specified:	Part 15.247(c)
Test Results:	Equipment complies with standard
Authorization Procedure:	Part 2.1053
Test Equipment Set Up:	See Block Diagram in Exhibit 7 Date: 3/02/04
Frequency Range Observed:	0 to 25 Ghz

NOTE: Simultaneous co-location transmit on the identical RF channels with the WM168b-Moles WLAN and the Bluetooth transmitter. All transmitters @ High Power.

RADIATED HARMONIC AND SPURIOUS EMISSIONS & RESTRICTED BANDS									
Frequency GHz	**Max. SA Rdg. dBu/V**	**Ant. Vert. or Horz.**	**Peak or Average Detector**	**Antenna Factor dB**	**Cable & filter loss dB**	**Amp Gain**	**Corrected Reading dBuV/m**	**Limit 74 Peak 54 Avg dBu/V**	**Margin in dB below LIMIT**
Fo - 2.412									
4.824	34.63	H	Peak	32.45	3.97	23.2	47.85	74	26.15
4.824	28.59	H	Average	32.45	3.97	23.2	41.81	54	12.19
7.236	34.47	H	Peak	36.77	3.42	25.9	48.76	74	25.24
7.236	28.31	H	Average	36.77	3.42	25.9	42.60	54	11.40
9.648	34.73	H	Peak	37.55	4.86	24.5	52.64	74	21.36
9.648	28.57	H	Average	37.55	4.86	24.5	46.48	54	7.52
Fo – 2.437									
4.874	37.86	H	Peak	32.45	3.97	23.2	51.08	74	22.92
4.874	27.34	H	Average	32.45	3.97	23.2	40.56	54	13.44
7.311	38.51	H	Peak	36.77	3.42	25.9	52.80	74	21.20
7.311	28.78	H	Average	36.77	3.42	25.9	43.01	54	10.99
9.746	37.84	H	Peak	37.55	4.86	24.7	55.55	74	18.45
9.746	27.75	H	Average	37.55	4.86	24.7	45.46	54	8.54
Fo – 2.462									
4.924	33.90	H	Peak	32.45	3.97	23.2	47.12	74	26.88
4.924	26.01	H	Average	32.45	3.97	23.2	39.23	54	14.77
7.386	35.27	H	Peak	36.77	3.42	25.9	49.56	74	24.44
7.386	22.30	H	Average	36.77	3.42	25.9	36.59	54	17.41
9.848	31.59	H	Peak	37.55	4.86	24.7	49.30	74	24.70
9.848	21.22	H	Average	37.55	4.86	24.7	38.95	54	15.07

Harmonic emissions on all three channels (low, mid & high) 5Fo – 10Fo at or below noise floor

Channel	**Frequency in GHz**	**Harmonics Observed**	**Limit 74 dBuV/m Peak & 54 dBuV/m Average**
Low Ch.	2.412		
5Fo – 10Fo	12.060 – 24.120	None -at or < noise floor @3m	All emissions < 54 dBuV/m
Mid Ch.	2.441		
5Fo – 10Fo	12.205 – 24.410	None -at or < noise floor @3m	All emissions < 54 dBuV/m
High Ch.	2.480		
5Fo – 10Fo	12.400 – 24.800	None -at or < noise floor @3m	All emissions < 54 dBuV/m

Exhibit 6 Test: Field Strength of Spurious Radiated Emissions

FCC ID: KBCIX300AC555WLBT
Applicant: ITRONIX Corp.
Model: IX300 with AirCard 555, WLAN, & Bluetooth
Frequency Range Observed: .30 to 9 GHz Date: 03/03/04

NOTE: Simultaneous co-location transmit with Part 22 Cellular and two Part 15 devices. The Part 15 WLAN and the Bluetooth transmitters were centered on the same RF channels for worst case.

RADIATED HARMONIC AND SPURIOUS EMISSIONS & RESTRICTED BANDS									
Frequency GHz	**Max. SA Rdg. dBu/V**	**Ant. Vert. or Horz.**	**Peak or Average Detector**	**Antenna Factor dB**	**Cable & filter loss dB**	**Amp Gain**	**Corrected Reading dBuV/m**	**Corrected Reading dBm**	**Margin dB below -13 dBm LIMIT**
Fo-825.25									
1650.50	37.79	V	Peak	25.70	1.75	26.7	38.54	-68.46	55.46
1650.50	34.29	H	Peak	25.70	1.75	26.7	35.04	-71.96	58.96
2475.75	<31.01	V	Peak	28.37	2.08	22.3	39.16	-67.84	54.84
2475.75	<30.27	H	Peak	28.37	2.08	22.3	38.42	-68.58	55.58
3301.00	32.60	V	Peak	30.45	2.37	21.7	43.72	-63.28	50.28
3301.00	<28.28	H	Peak	30.45	2.37	21.7	39.40	-67.60	54.60
Fo-836.5									
1673.00	36.22	V	Peak	25.70	1.75	26.7	36.97	-70.03	57.03
1673.00	33.78	H	Peak	25.70	1.75	26.7	34.53	-72.47	59.47
2509.50	<32.17	V	Peak	28.37	2.08	22.3	40.32	-66.68	53.68
2509.50	<31.92	H	Peak	28.37	2.08	22.3	40.07	-66.93	53.93
3346.00	35.07	V	Peak	30.45	2.37	21.7	46.75	-60.25	47.25
3346.00	34.73	H	Peak	30.45	2.37	21.7	46.41	-60.59	47.59
Fo-847.75									
1695.50	36.11	V	Peak	25.70	1.75	26.7	36.86	-70.14	57.14
1695.50	34.61	H	Peak	25.70	1.75	26.7	35.56	-71.44	58.44
2543.25	<31.81	V	Peak	28.37	2.08	22.3	39.96	-67.04	54.04
2543.25	<32.47	H	Peak	28.37	2.08	22.3	40.62	-66.38	53.38
3391.00	36.79	V	Peak	30.45	2.37	21.7	48.47	-58.53	45.53
3391.00	34.41	H	Peak	30.45	2.37	21.7	46.09	-60.91	47.91

Harmonic emissions on all three channels (low, mid & high) 5Fo – 10Fo at or below noise floor

Channel	Frequency in GHz	Harmonics Observed	Limit 43 + 10 Log(PO)
Low Ch.	825.25		
5Fo – 10Fo	4.126 – 8.2525	None -at or < noise floor @3m	All emissions < 54 dBuV/m
Mid Ch.	836.5		
5Fo – 10Fo	4.182 – 8.3650	None -at or < noise floor @3m	All emissions < 54 dBuV/m
High Ch.	847.75		
5F o- 10Fo	4.238 – 8.4775	None -at or < noise floor @3m	All emissions < 54 dBuV/m

NOTE: With external antenna removed from the IX300 and the transmitter output terminated to a non-radiating load per TIA-603B 2.2.12.2(c) only the above harmonics were measurable. The highest level radiated spurious emissions observed above, 4FO, (hi-lighted in Red), were re-tested using signal substitution and are reported in Test Report 1 for the AirCard 555.

< Denotes measured level at or below analyzer noise floor

Exhibit 6 Test: Field Strength of Spurious Radiated Emissions

FCC ID: KBCIX300AC555WLBT
Applicant: ITRONIX Corp.
Model: IX300 with AirCard 555, WLAN, & Bluetooth
Frequency Range Observed: 0 to 25 GHz Date: 03/04/04

NOTE: Simultaneous co-location transmit with Part 24 PCS and two Part 15 devices. The Part 15 WLAN and the Bluetooth transmitters were centered on the same RF channels for worst case.

RADIATED HARMONIC AND SPURIOUS EMISSIONS & RESTRICTED BANDS									
Frequency GHz	**Max. SA Rdg. dBu/V**	**Ant. Vert. or Horz.**	**Peak or Average Detector**	**Antenna Factor dB**	**Cable & filter loss dB**	**Amp Gain**	**Corrected Reading dBuV/m**	**Corrected Reading dBm**	**Margin in dB below -13 dBm LIMIT**
Fo-1850.2									
3700.4	<32.39	V	Peak	31.58	2.37	23.2	43.14	-63.86	50.86
3700.4	<30.64	H	Peak	31.58	2.37	23.2	41.39	-65.61	52.61
5551.6	<33.12	V	Peak	34.24	2.85	25.9	44.31	-62.69	49.69
5551.6	<30.39	H	Peak	34.24	2.85	25.9	41.58	-65.42	52.42
7400.8	<34.23	V	Peak	36.77	3.28	24.5	49.78	-57.22	44.22
7400.8	<32.58	H	Peak	36.77	3.28	24.5	48.13	-58.87	45.87
Fo-1880.0									
3760.0	<31.00	V	Peak	31.58	2.37	23.2	41.75	-65.25	52.25
3760.0	<31.81	H	Peak	31.58	2.37	23.2	42.56	-62.44	51.44
5640.0	<33.12	V	Peak	34.24	2.85	25.9	44.31	-62.69	49.69
5640.0	<32.85	H	Peak	34.24	2.85	25.9	44.04	-62.96	49.96
7520.0	<34.16	V	Peak	36.77	3.28	24.7	49.51	-57.49	44.49
7520.0	<34.39	H	Peak	36.77	3.28	24.7	43.18	-63.82	50.82
Fo-1909.8									
3819.6	<30.55	V	Peak	31.84	2.37	23.2	41.56	-65.44	52.44
3819.6	<30.64	H	Peak	31.84	2.37	23.2	41.65	-65.35	52.35
5729.4	<31.57	V	Peak	34.36.	2.85	25.9	42.88	-64.12	51.12
5729.4	<32.09	H	Peak	34.36	2.85	25.9	43.40	-63.60	50.60
7639.2	<33.93	V	Peak	36.87	3.28	24.7	49.38	-57.62	44.62
7639.2	<34.14	H	Peak	36.87	3.28	24.7	49.59	-57.41	44.41

Harmonic emissions on all three channels (low, mid & high) 5Fo – 10Fo at or below noise floor			
Channel	**Frequency in GHz**	**Harmonics Observed**	**Limit 43 + 10 Log(P)**
Low Ch.	1850.2		
5Fo – 10Fo	9.251 – 18.502	None -at or < noise floor @3m	All emissions < 54 dBuV/m
Mid Ch.	1880.0		
5Fo – 10Fo	9.400 – 18.800	None -at or < noise floor @3m	All emissions < 54 dBuV/m
High Ch.	1909.8		
5F o- 10Fo	9.549 – 19.098	None -at or < noise floor @3m	All emissions < 54 dBuV/m

* During preliminary measurements with the external antenna on the IX300 only the above harmonics were visible. However, when the transmitter output was terminated to a non-radiating load per TIA-603B 2.2.12.2(c) only the noise floor reported above was measurable. No radiated spurious emissions were re-tested using signal substitution as NONE were measurable above the noise floor.

End of Report