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FCC PART 15.247 FHSS TEST REPORT

APPLICANT	TriSquare Communications Inc.
ADDRESS	1420 N.W. Vivion Road Suite 113 Kansas City, MO 64118 – 4555 USA
TELEPHONE	816.505.3575
FCC ID	O9GTSX300
MODEL NUMBER	TSX300
PRODUCT DESCRIPTION	902-928 MHz Frequency Hopping Radio
DATE SAMPLE RECEIVED	December 15, 2006
DATE TESTED	December 29, 2006
TESTED BY	Nam Nguyen
APPROVED BY	Mario de Aranzeta C.E.T.
TIMCO REPORT NO	3403AUT6TestReport.PDF
TEST RESULTS	<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL

**THE ATTACHED REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL
WITHOUT THE WRITTEN APPROVAL OF TIMCO ENGINEERING, INC.**



Certificate # 0955-01

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STATEMENT OF COMPLIANCE

This equipment has been tested in accordance with the standards identified in the referenced test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report and demonstrate that the equipment complies with the appropriate standards.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025 requirements.

I attest that the necessary measurements were made by me or under my supervision, at Timco Engineering, Inc. located at 849 N.W. State Road 45, Newberry, Florida 32669 USA.



Authorized by: Mario de Aranzeta

Signature: On File

Function: Engineer

Date: January 9, 2007

Tested By: Nam Nguyen

Date: January 5, 2007

REPORT SUMMARY

Purpose of Test:	To show the DUT in compliant with FCC Part 15.247 requirements for 900 MHz FHSS radio.
Test Result:	The test results relate only to the items tested.
Related Report/Grant:	3403BUT6TestReport.pdf – Pt 15 Subpart B Test Report for weather receiver. The weather receiver is approved under the DoC procedure.

TEST ENVIRONMENT AND TEST SETUP

Test Facilities:	All measurements were made at one or more of the test sites of TIMCO ENGINEERING INC. located at 849 N.W. State Road 45, Newberry, FL 32669.
Laboratory Test Conditions:	Temperature: 26°C, Humidity: 55%
Test Exercise:	The DUT was set in continuous transmit mode of operation.
Deviation to the Standards:	No deviation from the standard.
Modification to the DUT:	No modification to the DUT
Test Exercise:	The EUT was set in continuous transmit mode of operation.
Supporting Equipment:	Not applicable

DUT DESCRIPTION

Description of Certified System:	The system is a handheld transceiver.
Product Description:	Telemetry Radio
FCC ID:	O9GTSX300
Model Number:	TSX300
Brand Name:	TriSquare
Operating Frequency:	902 – 928 MHz
Number of Channels:	50
Occupied Bandwidth:	11.5 kHz
Max. Output Pwr:	1 Watt
Type of Modulation:	Frequency hopper
EUT Power Source:	Primary Power – 4.8 Vdc-750mAh
	Secondary Power – N/A
Test Item:	Pre-production
Type of Equipment:	Portable
Antennas:	Permanently attached
Antenna Connector:	None

EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
3/10-Meter OATS	TEI	N/A	N/A	Listed 3/27/04	3/26/07
3-Meter OATS	TEI	N/A	N/A	Listed 1/11/06	1/10/09
Biconnical Antenna	Eaton	94455-1	1057	CAL 12/12/05	12/12/07
Biconnical Antenna	Electro-Metrics	BIA-25	1171	CAL 4/29/05	4/29/07
Analyzer Tan Tower Quasi-Peak Adapter	HP	85650A	3303a01690	CAL 12/8/05	12/8/07
Analyzer Tan Tower RF Preselector	HP	85685A	3221A01400	CAL 12/7/05	12/7/07
Analyzer Tan Tower Spectrum Analyzer	HP	8566B OPT 462	3188A07786 3144A20661	CAL 12/7/05	12/7/07
Analyzer Tan Tower Preamplifier	HP	8449B-H02	3008A00372	CAL 12/8/05	12/8/07
LISN	Electro-Metrics	EM-7820	2682	CAL 4/28/05	4/28/07
Log-Periodic Antenna	Eaton	96005	1243	CAL 12/14/05	12/14/07

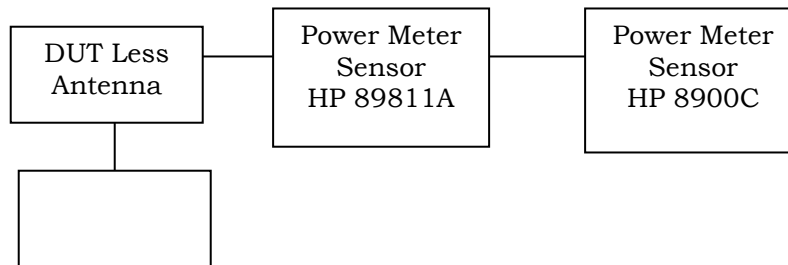
TEST PROCEDURES

Power Line Conducted Interference: The procedure used was ANSI C63.4-2003 using a 50uH LISN. The resolution bandwidth of the spectrum analyzer was 10 kHz with an appropriate sweep speed.

Bandwidth 20 dB: The measurements were made with the spectrum analyzer's resolution bandwidth (RBW) = 1 MHz and the video bandwidth (VBW) = 3 MHz and the span set as shown on plot.

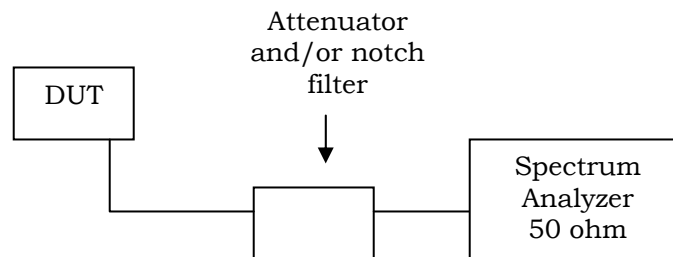
Power Output: Power was measured by disconnecting the antennas and measuring across a 50 ohm load as recommended by the manufacturer using a HP peak power meter Model 8900C. The antenna is non-directional and doesn't exceed 6 dBi gain. The power output was measured at three places in the band highest is reported below

Output Power Test Setup Diagram



Antenna Conducted Emissions: The RBW = 100 kHz, VBW = 300 kHz and the span set to 10.0 MHz and the spectrum was scanned from 30 MHz to the 10th Harmonic of the fundamental. Above 1 GHz the resolution bandwidth was 1 MHz and the VBW = 3 MHz and the span to 50 MHz.

RF Conducted Spurious Emissions Test Setup Diagram



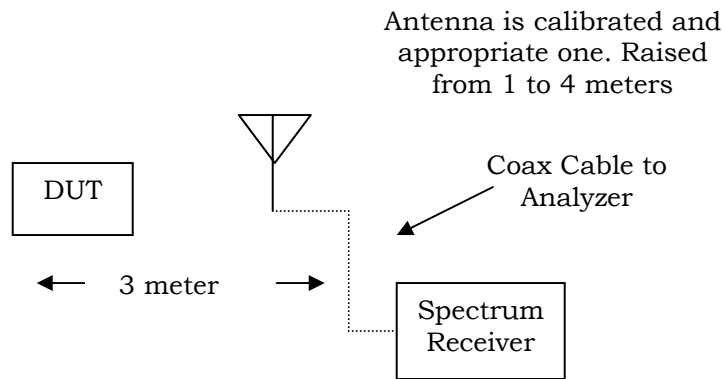
Note: The spectrum was scanned to the tenth harmonic.

[Continued]

Radiation Interference: The test procedure used was ANSI C63.4-2003 using an Agilent spectrum receiver with preselector. The bandwidth (RBW) of the spectrum receiver was 100 kHz up to 1 GHz and 1 MHz above 1 GHz with an appropriate sweep speed. The VBW above 1 GHz was 3 MHz. The analyzer was calibrated in dB above a microvolt at the output of the antenna.

Radiated Spurious Emissions Into Adjacent Restricted Band: An inband field strength measurement of the fundamental emission at the lowest and highest frequencies was made using the RBW and detector function required by C63.4-2003 and FCC Rules.

Radiated Spurious Emissions: The procedure used was ANSI standard C63.4-2003 & the FCC/OET Guidance on Measurements for Direct Sequence Spread Spectrum Systems – Public Notice 54797 Dated July 12, 1995.



DUT is placed 80 cm above groundplane on a rotatable platform

POWER LINE CONDUCTED INTERFERENCE

Rules Part No.: 15.207(a)

Requirements:

Emission Frequency (MHz)	Conducted Limit (dB μ V)	
	Quasi-peak (QP)	Average (AV)
0.15 – 0.5	66 to 56 *	56 to 46 *
0.5 – 5	56	46
5 – 30	60	50
* Decreases with the logarithm of the frequency.		

Test Data: Not applicable to this device.

20 dB BANDWIDTH

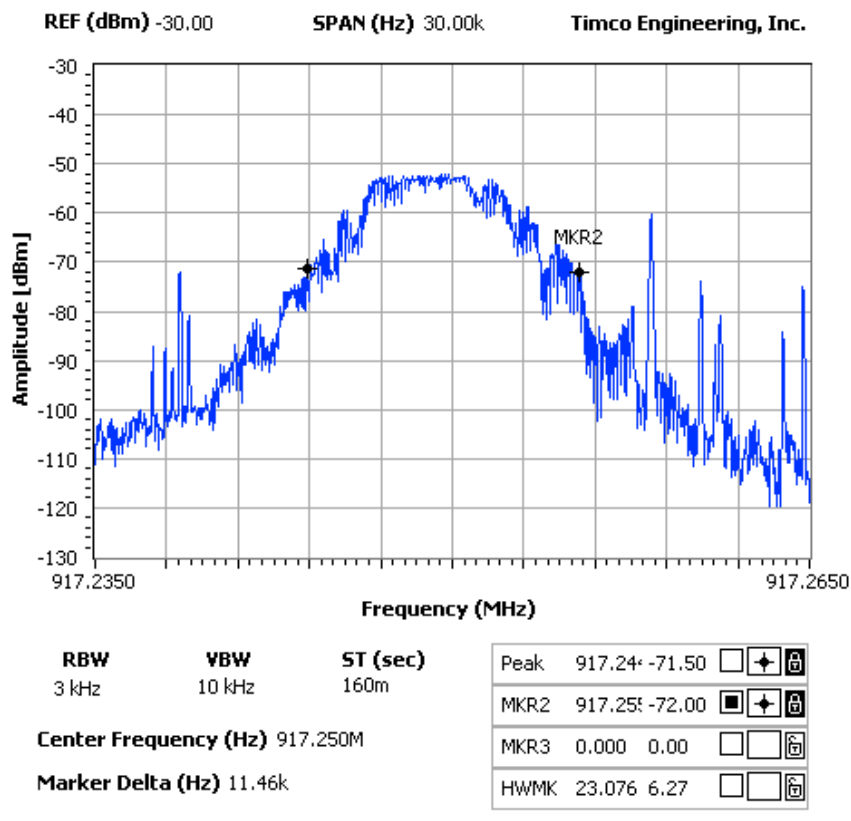
RULES PART NO.: 15.247(a)(2)

REQUIREMENTS: The 20 dB bandwidth must be less than 500 kHz.

TEST DATA: 11.5 kHz

NOTES:

TRISQUARE COMMUNICATIONS INC. - FCC ID: O9GTBD
20 dB BANDWIDTH PLOT



Three places in the band were measured and the worst case presented above.

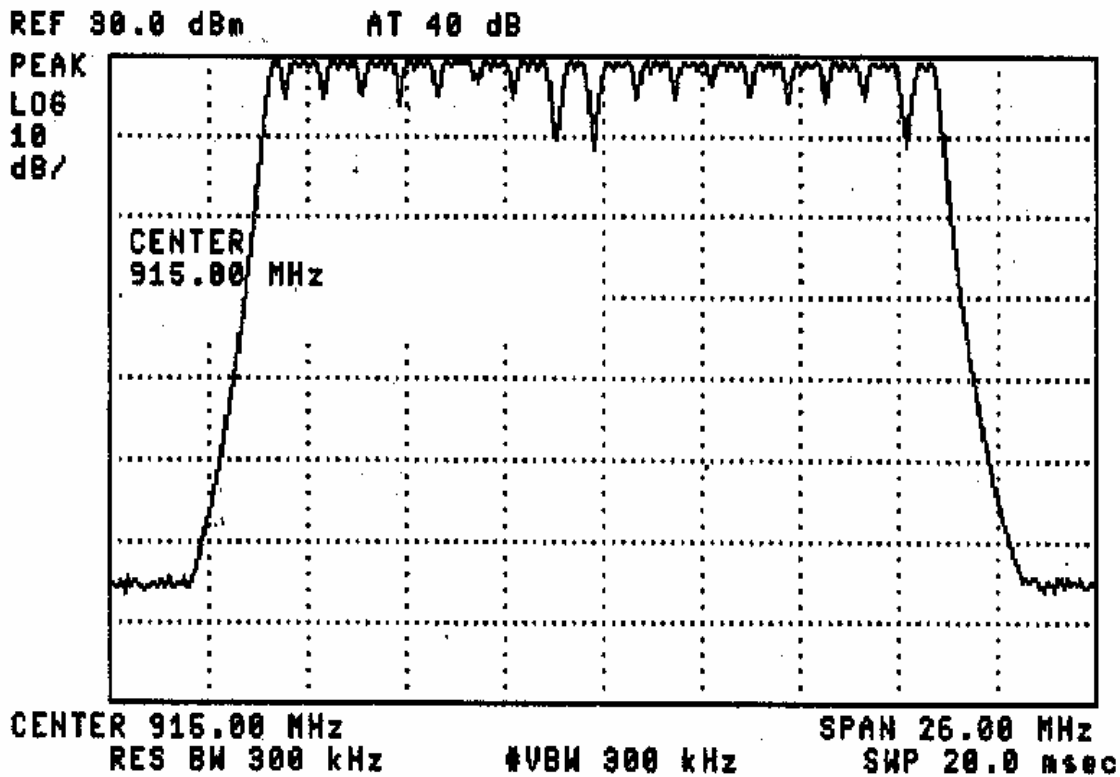
NUMBER OF HOPPING CHANNELS

Rules Part No.: 15.247(a)(1)

Requirements:

902-928 MHz	If the 20 dB bandwidth is less than 250 kHz, the system shall use at least 50 hopping frequencies.
	If the 20 dB bandwidth is 250 kHz or greater, the system shall use at least 25 hopping frequencies.
2400-2483.5 MHz	At least 15 channels
5725-5850 MHz	At least 75 channels

Test Data: There are 50 hopping channels



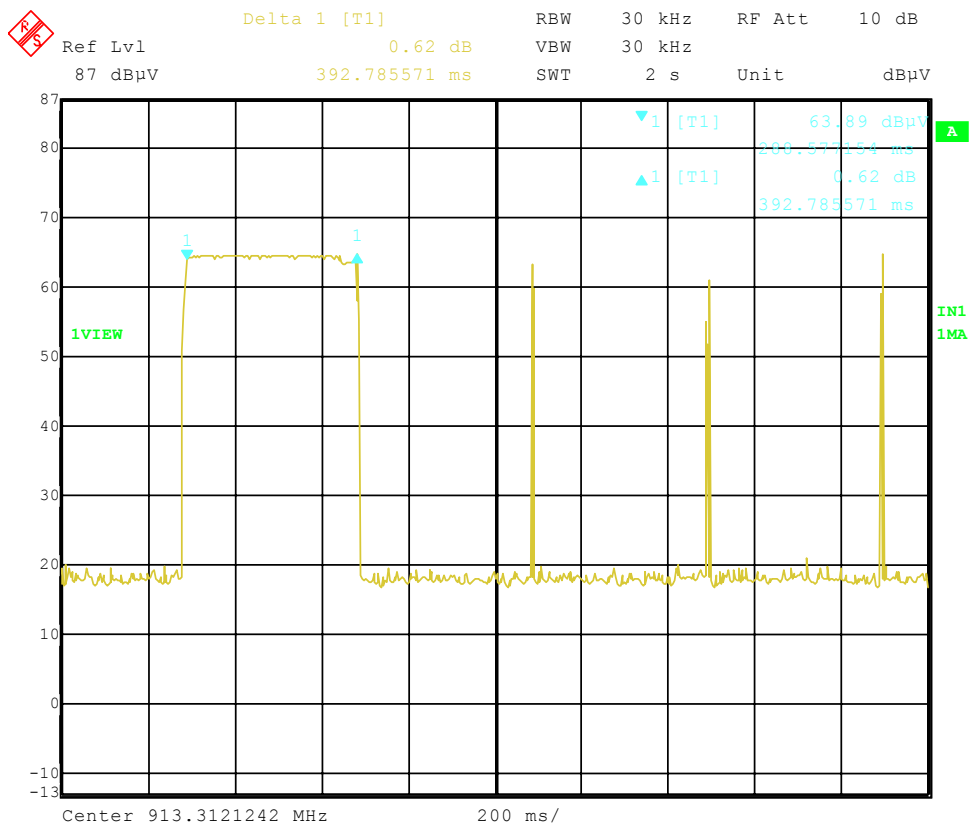
DWELL TIME OF A HOPPING CHANNEL

Rules Part No.: 15.247(a)(1)(i)

Requirements:

902-928 MHz	If 20 dB bandwidth is less than 250 kHz, Dwell time \leq 0.4 seconds in a 20 second period.
	If 20 dB bandwidth is 250 kHz or greater, Dwell time \leq 0.4 seconds in a 10 second period.
2400-2483.5 MHz	\leq 0.4 seconds in a 0.4 seconds multiplied the number of hopping channels employed.
5725-5850 MHz	\leq 0.4 seconds in a 30 second period.

Test Data: The dwell time is 392 msec.



Three places in the band were measured and the worst case presented above.

POWER OUTPUT

Rules Part No.: 15.247(b)

Requirements: The maximum peak output power shall not exceed 1 watt (30 dBm). If directional transmitting antennas with a gain of more than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Test Data:

Channel No.	Frequency MHz	Output Power mW	Output Power dBm
1	906.275	948	29.7
25	915.0	998	30
50	923.750	957	29.8

Note: TriSquare provided a special sample with an output connector for conducted output power measurements.

SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Rules Part No.: 15.247(c)

Requirements: Emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.

Test Data:

N/A as the antennas is permanently attached.

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FIELD STRENGTH OF SPURIOUS EMISSIONS

Rules Part No.: 15.247(c), 15.205 & 15.209(b)

Requirements:

§15.247(c) & §15.205	
(Fundamental) Frequency	Limits
902 – 928MHz 2.4 – 2.4835GHz	127.37dBuV/m
Harmonics (restricted)	54 dBuV/m @3m

Emissions that fall in the restricted bands (15.205) must be less than or equal to 500 uV/m (54 dBuV/m). Spurious not in a restricted band must be 20 dBc.

Test Data: The data was presented in the following tables.

Harmonics were measured to the 10th harmonic.

Notes: All emissions measured using a peak detector. Except as noted below. Emissions marked with ** were measured using an averaging detector.

Emissions between 30 – 1000 MHz

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Polarity V/H	Coax Loss dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB
915.0	768.00	7.7	H	1.84	21.52	31.06	>20
915.0	768.00	17.6	V	1.84	20.78	40.22	>20
915.0	789.00	14.7	H	1.88	21.59	38.17	>20
915.0	789.00	25.3	V	1.88	20.89	48.07	>20
915.0	810.26	19.7	H	1.91	21.71	43.32	>20
915.0	810.26	28.1	V	1.91	21.11	51.12	>20
915.0	831.19	17.5	H	1.92	22.15	41.57	>20
915.0	831.19	26.8	V	1.92	21.42	50.14	>20
915.0	852.15	12.2	H	1.93	22.64	36.77	>20
915.0	852.15	26.4	V	1.93	22.16	50.49	>20
915.0	873.08	26.0	H	1.94	23.09	51.03	>20
915.0	873.08	29.5	V	1.94	22.40	61.94	>20

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Polarity V/H	Coax Loss dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB
906.3	906.28	93	H	1.96	23.36	118.32	9.06
906.3	906.28	102.5	V	1.96	22.64	127.1	0.28
906.3	1,812.55	37.5	H	2.75	30.08	70.33	36.77
906.3	1,812.55	48.3	V	2.75	30.08	81.13	25.97
906.3	2,718.83	9.1	V	3.4	32.86	45.36	8.64
906.3	2,718.83	11.7	H	3.4	32.86	47.96	6.04
906.3	3,625.10	8.2	V	4.16	33.40	45.76	8.24
906.3	3,625.10	10.6	H	4.16	33.40	48.16	5.84
906.3	4,531.38	8.0	H	4.77	34.13	46.9	7.10
906.3	4,531.38	8.7	V	4.77	34.13	47.6	6.40
906.3	5,437.65	7.3	V	5.13	35.03	47.46	6.54
906.3	5,437.65 *	15.8	H	5.13	35.03	55.96	18.04
906.3	5437.65 **	17.6	H	5.13	25.32	48.05	5.95
906.3	6,343.93	7.1	V	5.4	35.98	48.48	5.52
906.3	6,343.93	7.3	H	5.4	35.98	48.68	5.32
906.3	7,250.20	6.7	H	5.75	36.2	48.65	5.35
906.3	7,250.20	6.8	V	5.75	36.2	48.75	5.25
906.3	8,156.48	6.9	H	6.26	36.3	49.46	4.54
906.3	8,156.48	7.1	V	6.26	36.3	49.66	4.34
906.3	9,062.75	8.3	H	6.62	36.88	51.8	2.20
906.3	9,062.75	8.4	V	6.62	36.88	51.9	2.10

* Peak. The limit is 74dBuV/m

** Average. The limit is 54 dBuV/m

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Polarity V/H	Coax Loss dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB
915	915.00	92.9	H	1.97	23.35	118.22	9.16
915	915.00	102.1	V	1.97	22.60	126.67	0.71
915	1,830.00	41.7	H	2.76	30.18	74.64	32.03
915	1,830.00	51.4	V	2.76	30.18	84.34	22.33
915	2,745.00	10.1	V	3.42	32.89	46.41	7.59
915	2,745.00	12.3	H	3.42	32.89	48.61	5.39
915	3,660.00	8.8	V	4.19	33.43	46.42	7.58
915	3,660.00	9.3	H	4.19	33.43	46.92	7.08
915	4,575.00	7.6	V	4.79	34.16	46.55	7.45
915	4,575.00	9.9	H	4.79	34.16	48.85	5.15
915	5,490.00	7.5	H	5.15	35.09	47.74	6.26
915	5,490.00	7.6	V	5.15	35.09	47.84	6.16
915	6,405.00	6.7	V	5.42	36.02	48.14	5.86
915	6,405.00	7.3	H	5.42	36.02	48.74	5.26
915	7,320.00	7.3	V	5.79	36.28	49.37	4.63
915	7,320.00	7.4	H	5.79	36.28	49.47	4.53
915	8,235.00	6.8	H	6.29	36.30	49.39	4.61
915	8,235.00	7.1	V	6.29	36.30	49.69	4.31
915	9,150.00	7.8	H	6.65	36.98	51.43	2.57
915	9,150.00	8.2	V	6.65	36.98	51.83	2.17

* Peak. The limit is 74dBuV/m

** Average. The limit is 54 dBuV/m

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Polarity V/H	Coax Loss dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB
923.8	923.75	91.5	H	1.99	23.38	116.87	10.51
923.8	923.75	102.5	V	1.99	22.64	127.13	0.25
923.8	1,847.50	45.4	H	2.78	30.29	78.47	28.66
923.8	1,847.50	52.8	V	2.78	30.29	85.87	21.26
923.8	2,771.25	10.1	V	3.44	32.93	46.47	7.53
923.8	2,771.25 *	20.4	H	3.44	32.93	56.77	17.23
923.8	2771.25 **	14.6	H	3.44	32.93	50.97	3.03
923.8	3,695.00	14.2	V	4.23	33.46	51.89	2.11
923.8	3,695.00 *	17.3	H	4.23	33.46	54.99	19.01
923.8	3695.00 **	14.7	H	4.23	33.46	52.39	1.61
923.8	4,618.75	8.9	V	4.81	34.2	47.91	6.09
923.8	4,618.75	12.7	H	4.81	34.2	51.71	2.29
923.8	5,542.50	13.3	V	5.16	35.15	53.61	0.39
923.8	5,542.50	16.8	H	5.16	35.15	57.11	16.89
923.8	5542.50 **	18.9	H	5.16	25.5	49.56	4.44
923.8	6,466.25	17.9	H	5.44	36.07	59.41	47.72
923.8	6,466.25	19.0	V	5.44	36.07	60.51	46.62
923.8	8,313.75	8.8	V	6.33	36.3	51.43	2.57
923.8	8,313.75	10.4	H	6.33	36.3	53.03	0.97
923.8	9,237.50	10.0	H	6.67	37.09	53.76	0.24
923.8	9,237.50	10.5	V	6.67	37.09	54.26	52.87

* Peak. The limit is 74dBuV/m

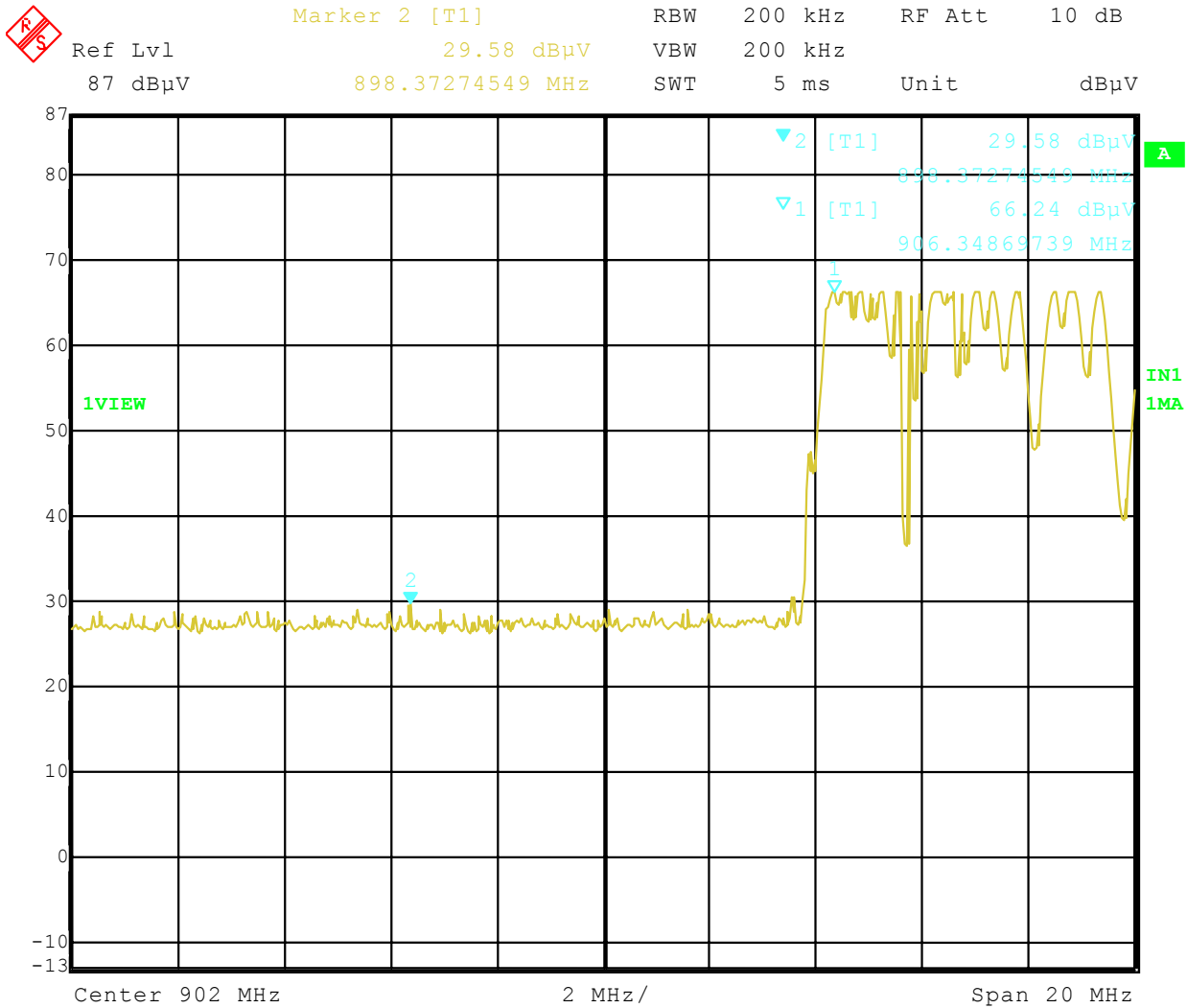
** Average. The limit is 54 dBuV/m

RADIATED SPURIOUS EMISSIONS INTO ADJACENT RESTRICTED BAND

Rule Parts No.: Pt 15.247 (c)

Requirements: Emissions that fall in the restricted bands (15.205) must be less than or equal to 500 uV/m (54dBuV/m). Emissions not in the restricted band must be 20 dBc.

Test Data: The plots are presented below.





Marker 2 [T1] RBW 200 kHz RF Att 10 dB
 Ref Lvl 29.06 dBuV VBW 200 kHz
 87 dBuV 930.46492986 MHz SWT 5 ms Unit dBuV

