



849 NW State Road 45
Newberry, FL 32669 USA
Ph: 888.472.2424 or 352.472.5500
Fax: 352.472.2030
Email: info@timcoengr.com
Website: www.timcoengr.com

FCC PART 15.247 TEST REPORT

DIGITAL SPREAD SPECTRUM

Applicant	T&D CORPORATION
Address	817-1 SHIMADACHI MATSUMOTO 390-0852
FCC ID	SRD50050
Model Number	RTR-601
Product Description	CORE TEMPERATURE LOGGER
Date Sample Received	8/30/2013
Date Tested	9/5/2013
Tested By	NAM NGUYEN
Approved By	NAM NGUYEN
Report Number	1505AUT13TestReport.docx
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.**



Testing Certificate # 0955-01



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GENERAL REMARKS

The attached report shall not be reproduced except in full without the written permission of Timco Engineering Inc.

The test results relate only to the items tested.

Summary

The device under test does:

- fulfill the general approval requirements as identified in this test report
- not fulfill the general approval requirements as identified in this test report

Attestations

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

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025: 2005 requirements.



Testing Certificate # 0955-01

I attest that the necessary measurements were made, under my supervision, at:

Timco Engineering Inc.
849 NW State Road 45
Newberry, FL 32669



Authorized Signatory Name:

Nam Nguyen
Project Manager / Testing Technician

Date: September 13, 2013

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GENERAL INFORMATION

DUT Specification

Applicable Standard	Part 15.247		
DUT Description	Core Temperature Logger		
FCC ID	SRD50050		
Operating Frequency	TX: 902 – 928 MHz		
Number of channels	22		
DUT Power Source	<input type="checkbox"/> 110–120Vac/50– 60Hz		
	<input type="checkbox"/> DC Power		
	<input checked="" type="checkbox"/> Battery Operated Exclusively		
Test Item	<input type="checkbox"/> Prototype	<input checked="" type="checkbox"/> Pre-Production	<input type="checkbox"/> Production
Type of Equipment	<input checked="" type="checkbox"/> Fixed	<input type="checkbox"/> Mobile	<input type="checkbox"/> Portable
Antenna Connector	None		
Antenna	Integral antenna		
Test Facility	Timco Engineering Inc. located at 849 NW State Road 45 Newberry, FL 32669 USA.		
Test Conditions	Temperature: 26°C Relative humidity: 50%		
Test Exercise	The DUT was placed in continuous transmit mode of operation.		

Test Supporting Equipment

Supporting Device	Manufacturer	Model / FCC ID	Serial Number
N/A			

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EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	12/31/11	12/31/13
Antenna: Biconnical	Eaton	94455-1	1096	05/10/13	05/10/15
Antenna: Log-Periodic	Electro-Metrics	LPA-25	1122	05/09/13	05/09/15
Antenna: Double-Ridged Horn/ETS Horn 1	ETS-Lindgren	3117	00035923	12/07/11	12/07/13
Coaxial Cable - Chamber 3 cable set	Semiflex	Unknown	Chamber 3 cable set	01/26/12	01/26/14
Digital Multimeter	Fluke	77	43850817	02/22/12	02/22/14
EMI Test Receiver	Rhode & Schwarz	ESIB 40	100274	03/13/12	03/16/14
High Pass Filter	Microlab	HA-10N		05/17/13	05/17/15
High Pass Filter	Microlab	HA-20N		05/17/13	05/17/15
Hygro-Thermometer	Extech	445703	0602	06/20/13	06/20/15
LISN	Electro-Metrics	ANS-25/2	2604	10/28/11	10/28/13
Measuring Tape-20M	Kraftixx	0631-20		05/20/13	05/20/15
RF Power Meter	Boonton	4531	11793	01/19/13	01/19/15
Sensor	Boonton	51072A	34647	01/19/13	01/19/15
Analyzer Tan Tower Preamplifier	HP	8449B-H02	3008A00372	10/28/11	10/28/13
Analyzer Tan Tower Quasi-Peak Adapter	HP	85650A	3303A01690	10/28/11	10/28/13
Analyzer Tan Tower RF Preselector	HP	85685A	3221A01400	10/28/11	10/28/13
Analyzer Tan Tower Spectrum Analyzer	HP	8566B Opt 462	3138A07786 3144A20661	10/28/11	10/28/13

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TEST PROCEDURES

Radiation Interference: ANSI C63.4-2003 using a spectrum analyzer, a preselector, a quasi-peak adapter, and an appropriate antenna. The analyzer was calibrated in dB above a microvolt at the output of the antenna. The resolution bandwidth was 100 kHz with an appropriate sweep speed and the video bandwidth was 300 kHz up to 1 GHz and 1 MHz with a video BW of 3 MHz above 1 GHz. When an emission was found, the table was rotated to produce the maximum signal strength. The antenna was placed in both the horizontal and vertical planes and the worse case emissions were reported. The spectrum was searched to at least the tenth (10) harmonic of the fundamental.

Formula Of Conversion Factors: The field strength at 3m was established by adding the meter reading of the spectrum analyzer (which is set to read in units of dBμV) to the antenna correction factor supplied by the antenna manufacturer plus the coax loss. The antenna correction factors are stated in terms of dB. The gain of the preselector was accounted for in the spectrum analyzer meter reading.

Example:

Freq (MHz)	Meter Reading	+ ACF	+ CL = FS
33	20 dBμV	+ 10.36 dB	+ 0.5 = 30.86 dBμV/m @ 3m

Power Line Conducted Interference: The procedure used was ANSI C63.4-2003 using a 50uH LISN. Both lines were observed. The bandwidth of the spectrum analyzer was 10 kHz with an appropriate sweep speed. The spectrum was scanned from 0.15 to 30 MHz.

Occupied Bandwidth: A small sample of the transmitter output was fed into the spectrum analyzer and the attached plot was printed. The vertical scale is set to -10 dBm per division.

Bandwidth 6.0dB: 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: The RF power output was measured at the antenna feed point using a peak power meter.

Antenna Conducted Emissions: The RBW=100 kHz, VBW=300 kHz and the span set to 10 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.

ANSI C63.4-2003 10.1 Measurement Procedures: The DUT was placed on a table 80 cm high and with dimensions of 1m by 1.5m. The DUT was placed in the center of the table (1.5m side). The table used for radiated measurements is capable of continuous rotation.

When an emission was found, the table was rotated to produce the maximum signal strength. At this point, the antenna was raised and lowered from 1m to 4m. The antenna was placed in both the horizontal and vertical planes. Emissions attenuated more than 20 dB below the permissible value are not reported.

RADIATION INTERFERENCE

Rules Part No.: 15.247, 15.209

Requirements:

Frequency	Limits
Part 15.209	
9 to 490 kHz	2400/F (kHz) $\mu\text{V}/\text{m}$ @ 300 meters
490 to 1705 kHz	24000/F (kHz) $\mu\text{V}/\text{m}$ @ 30 meters
1705 kHz to 30 MHz	29.54 dB $\mu\text{V}/\text{m}$ @ 30 meters
30 – 88	40.0 dB $\mu\text{V}/\text{m}$ @ 3 meters
80 – 216	43.5 dB $\mu\text{V}/\text{m}$ @ 3 meters
216 – 960	46.0 dB $\mu\text{V}/\text{m}$ @ 3 meters
Above 960	54.0 dB $\mu\text{V}/\text{m}$ @ 3 meters
Part 15.247	
Fundamental 902 – 928 MHz	127.37 dB $\mu\text{V}/\text{m}$ @ 3 meters
Fundamental 2.4 – 2.4835 MHz	127.37 dB $\mu\text{V}/\text{m}$ @ 3 meters
Harmonics	54.0 dB $\mu\text{V}/\text{m}$ @ 3 meters

Any emissions that fall in the restricted bands (15.205) must be less than or equal to 54 dB $\mu\text{V}/\text{m}$. Spurious emissions not in a restricted band must be 20 dBc. Harmonics were checked through the 10th harmonic.

Test Data: All values are peak unless noted.
Items mark with an * designate a frequency in a restricted band.

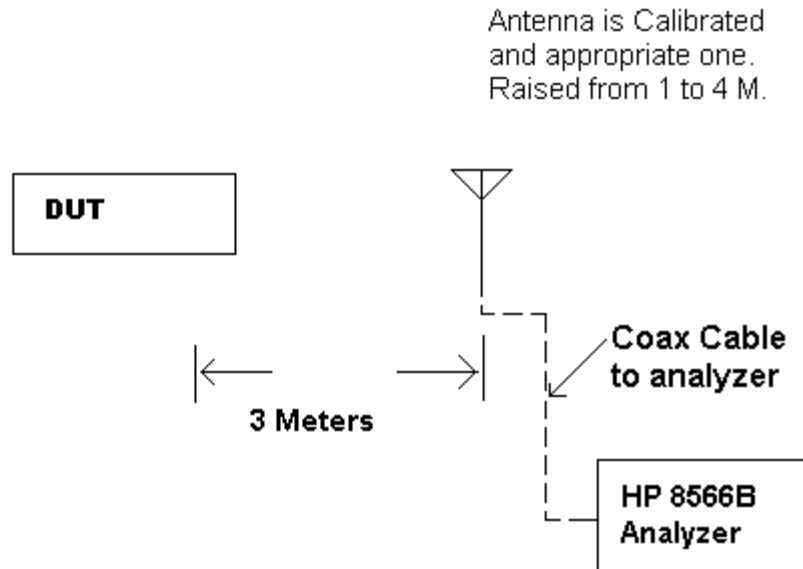
Tuned Frequency MHz	Emission Frequency MHz		Meter Reading dBuV	Detector	Ant. Polarity	Coax Loss dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB
902.9	902.94		74.1	Peak	H	1.95	21.88	97.93	29.45
902.9	902.94		75.9	Peak	V	1.95	21.88	99.73	27.65
902.9	1,805.88		19.7	Peak	H	2.74	30.47	52.91	26.82
902.9	1,805.90		21.3	Peak	V	2.74	30.47	54.51	25.22
902.9	2,708.80	*	19.1	Peak	H	3.4	32.77	55.27	18.73
	2,708.80	*	5.8	Avg	H	3.4	32.77	41.97	12.03
902.9	2,708.80	*	17.1	Peak	V	3.4	32.77	53.27	0.73
902.9	3,662.40	*	10.3	Peak	H	4.2	33.26	47.76	6.24
902.9	7,223.50		11.9	Peak	H	5.73	36.16	53.79	0.21
902.9	8,126.40	*	11.4	Peak	V	6.25	36.1	53.75	0.25
902.9	9,029.40	*	10.6	Peak	H	6.61	36.22	53.43	0.57
915.6	915.61		71.9	Peak	H	1.97	22.47	96.34	31.04
915.6	915.61		76.2	Peak	V	1.97	22.47	100.64	26.74
915.6	1,831.20		21.1	Peak	V	2.76	30.62	54.48	26.16
915.6	1,831.22		19.4	Peak	H	2.76	30.62	52.78	27.86

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Tuned Frequency MHz	Emission Frequency MHz		Meter Reading dBuV	Detector	Ant. Polarity	Coax Loss dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB
915.6	2,746.80	*	15.7	Peak	H	3.42	32.8	51.92	2.08
915.6	2,746.80	*	22.6	Peak	V	3.42	32.8	58.82	15.18
	2,746.80	*	8.3	Avg	V	3.42	32.8	44.52	9.48
915.6	3,662.40	*	11.9	Peak	H	4.2	33.26	49.36	4.64
915.6	7,323.90	*	11	Peak	V	5.79	36.14	52.93	1.07
915.6	7,324.90	*	15.1	Peak	H	5.79	36.14	57.03	16.97
	7,324.90	*	4.3	Avg	H	5.79	36.14	46.23	7.77
915.6	9,156.10	*	12.1	Peak	H	6.65	36.32	55.07	18.93
	9,156.10	*	2.5	Avg	H	6.65	36.32	45.47	8.53
927.1	927.13		68.2	Peak	V	1.99	23.1	93.29	34.09
927.1	927.13		72.3	Peak	V	1.99	23.1	97.39	29.99
927.1	1,854.26		19.1	Peak	H	2.78	30.75	54.23	23.16
927.1	1,854.30		23	Peak	V	2.78	30.75	56.53	20.86
927.1	2,781.40	*	15.8	Peak	H	3.45	32.83	52.08	1.92
927.1	2,781.40	*	17.3	Peak	V	3.45	32.83	53.58	0.42
927.1	3,708.50	*	10.4	Peak	V	4.24	33.31	47.95	6.05
927.1	3,708.50	*	12.8	Peak	H	4.24	33.31	50.35	3.65
927.1	4,635.60	*	10.6	Peak	V	4.82	34.28	49.7	4.3
927.1	4,635.65	*	12.7	Peak	H	4.82	34.28	51.8	2.2
927.1	6,489.90		10.7	Peak	V	5.45	35.89	52.04	1.96
927.1	6,489.90		11.5	Peak	H	5.45	35.89	52.84	1.16
927.1	7,417.04	*	11.7	Peak	V	5.85	36.12	53.67	0.33
927.1	7,417.10	*	16.7	Peak	H	5.85	36.12	58.67	15.33
	7,417.10	*	2.7	Avg	H	5.85	36.12	44.67	9.33
927.1	8,344.17	*	10.7	Peak	V	6.34	36.1	53.14	0.86
927.1	9,271.30		10.6	Peak	V	6.68	36.42	53.7	0.3
927.1	9,271.30		13	Peak	H	6.68	36.42	56.1	17.9
	9,271.30		2.4	Avg	H	6.68	36.42	45.5	8.5

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Method of Measuring Radiated Spurious Emissions



METHOD OF MEASUREMENT: The procedure used was ANSI standard C63.4-2003 & the FCC/OET Guidance on Measurements for Spread Spectrum Systems – KDB 558074 dated April 9, 2013.

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POWER LINE CONDUCTED INTERFERENCE

Rules Part No.: Part 15.207

Requirements:

Frequency (MHz)	Quasi Peak Limits (dB μ V)	Average Limits (dB μ V)
0.15 – 0.5	66 – 56 *	56 – 46 *
0.5 – 5.0	56	46
5.0 – 30	60	50
* Decrease with logarithm of frequency		

Test Data: N/A
Battery powered DUT.

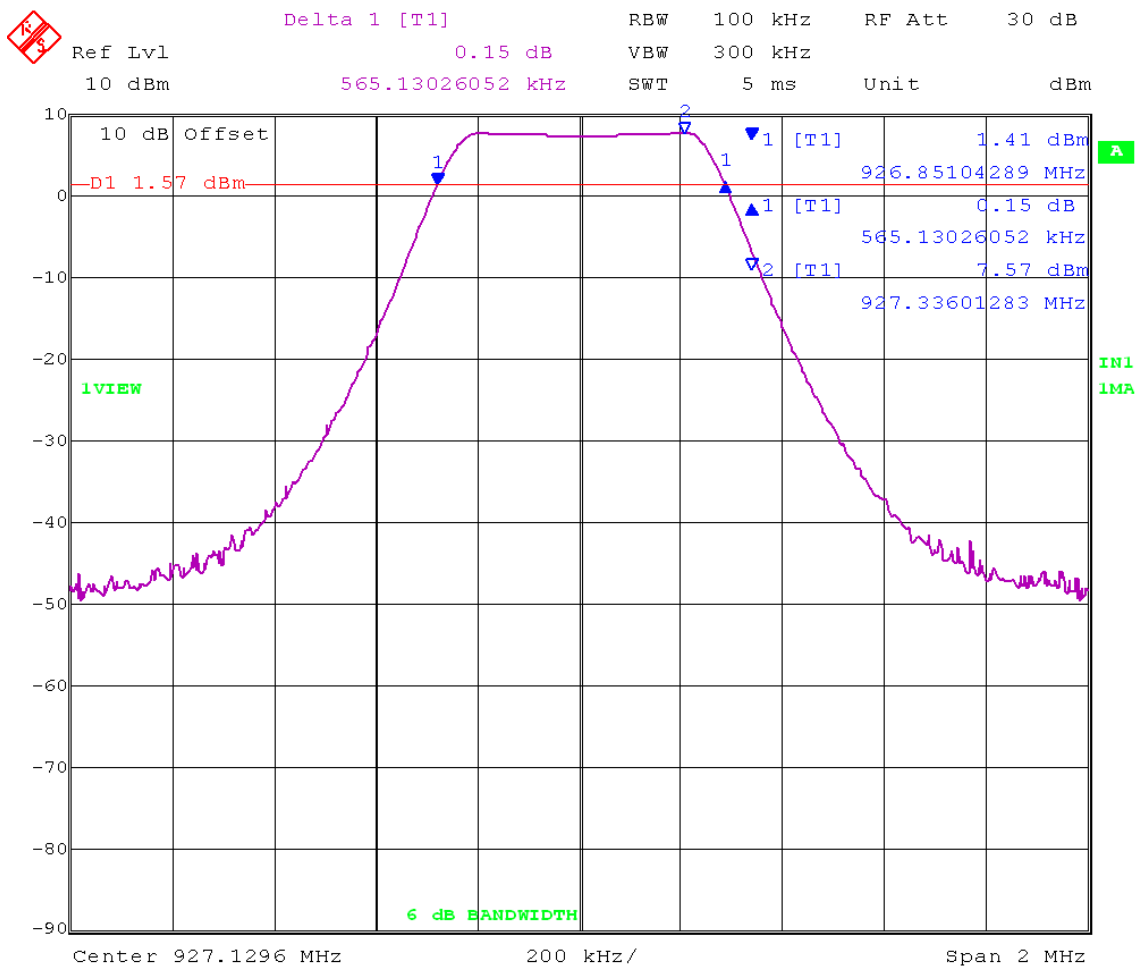
OCCUPIED BANDWIDTH

Rules Part No.: 15.247(a)(2)

Requirements: The 6 dB bandwidth must be greater than 500 kHz.

Test Data: The 6 dB bandwidth is 565 kHz.

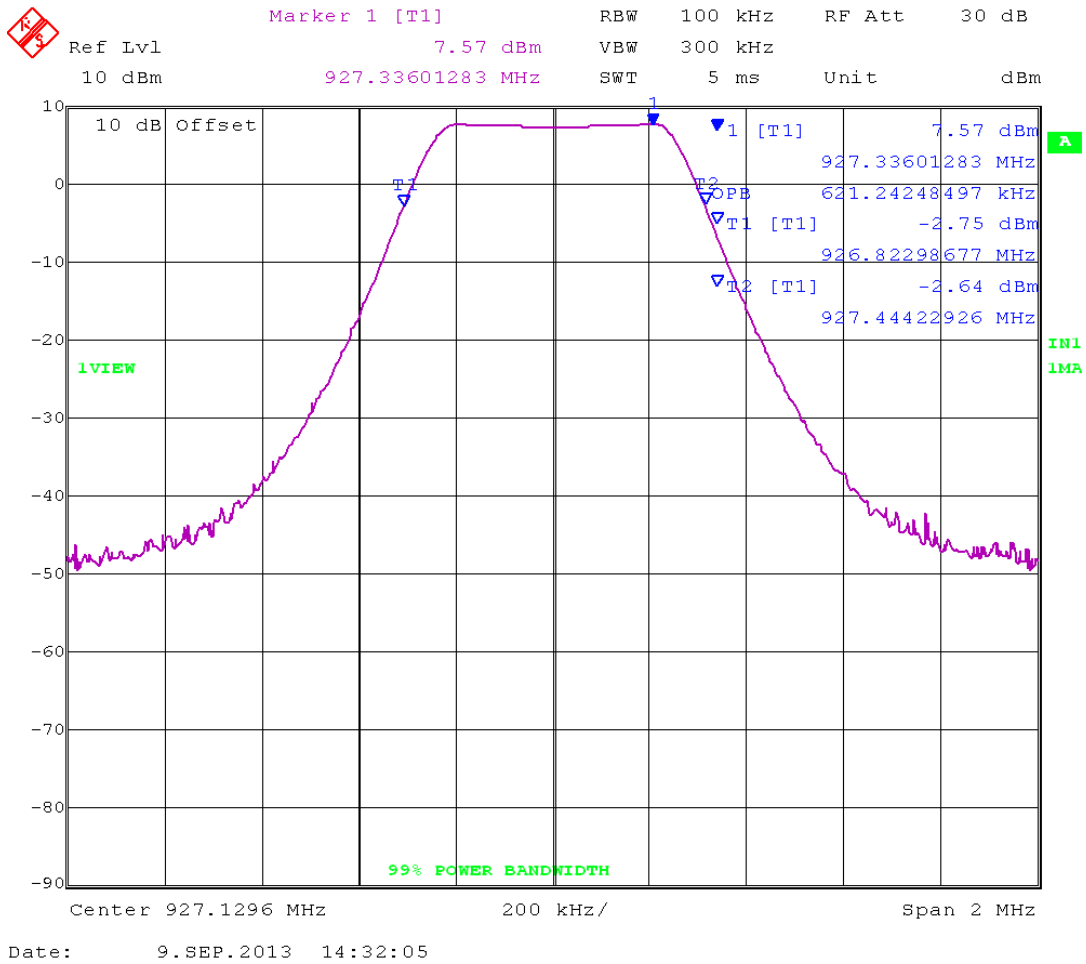
Three places in the band were measured and the worst case reported.



Date: 9.SEP.2013 14:19:01

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Test Data: The 99% power bandwidth is 621 kHz.

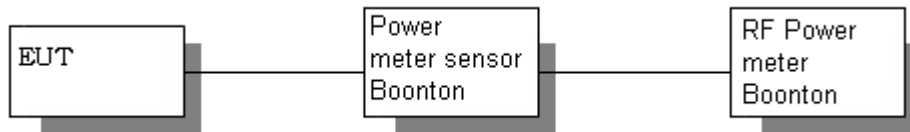


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POWER OUTPUT

Rules Part #: 15.247(b) 1 Watt conducted, 4W ERP

TEST SET UP:



Harmonics were checked through the 10th harmonic

Test Results: Calculated with 0dBi antenna gain.

Frequency MHz	Po dBm	Po milli-Watts
902.94	7.1	5.1
915.61	7.6	5.8
927.13	8.1	6.5

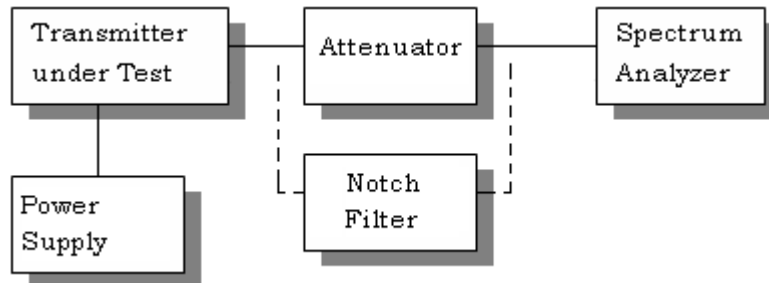
SPURIOUS EMISSIONS AT ANTENNA TERMINALS

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

Test Data:

N/A, Device has permanently attached antenna and no antenna connector.

15.247(c) Method of Measuring RF Conducted Spurious Emissions

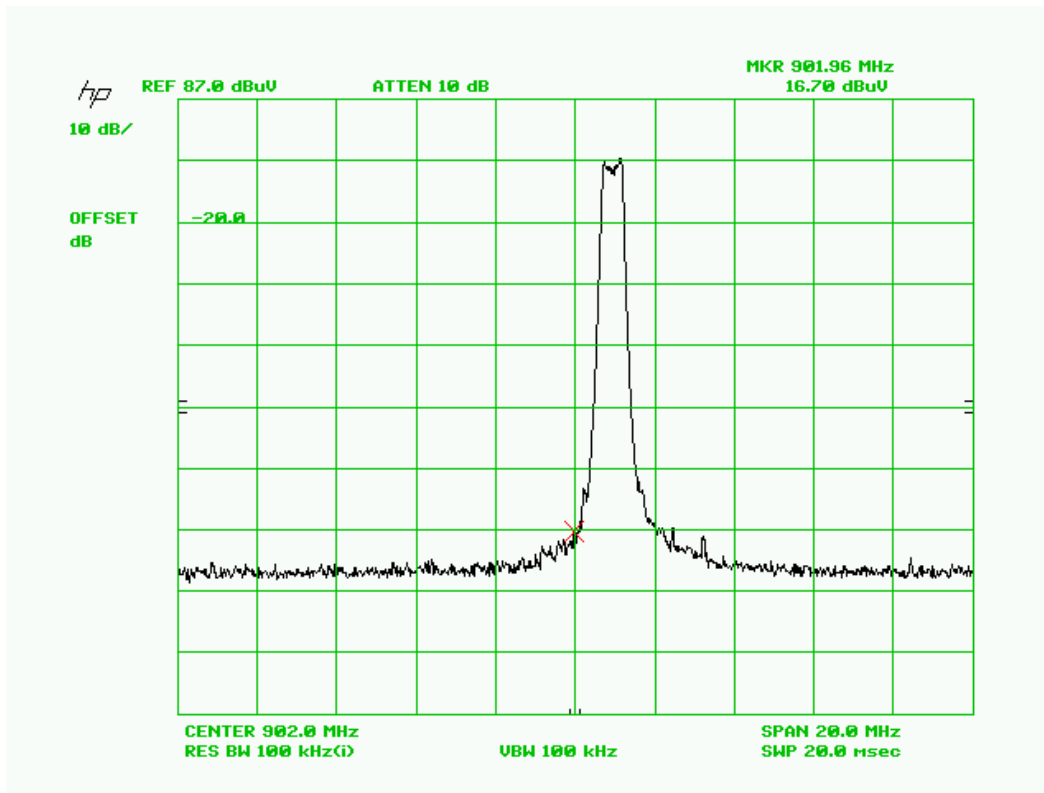


RADIATED SPURIOUS EMISSIONS INTO ADJACENT RESTRICTED BAND

Requirements: Emissions that fall in the restricted bands (15.205). These emissions must be less than or equal to 500 $\mu\text{V}/\text{m}$ (54 $\text{dB}\mu\text{V}/\text{m}$).

Test Procedure: An in band field strength measurement of the fundamental Emission using the RBW and detector function required by C63.4-2000 and FCC Rules. The procedure was repeated with an average detector and a plot made. The calculated field strength in the adjacent restricted band is presented below.

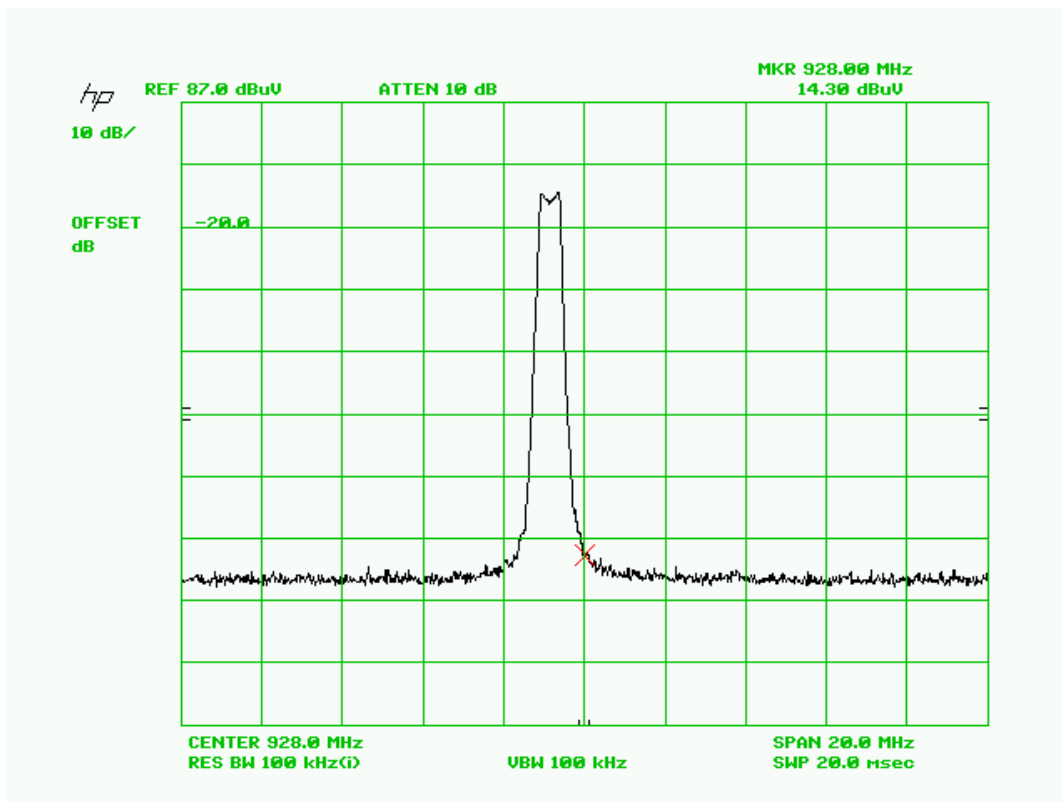
Lower bandedge ch 0 (902.9376 MHz) Peak Vert.



Tuned Frequency MHz	Emission Frequency MHz	Meter Reading $\text{dB}\mu\text{V}$	Ant. Pol	Coax Loss dB	Correction Factor dB/m	Field Strength $\text{dB}\mu\text{V}/\text{m}$	Margin dB
902.9	901.96	16.7	V	1.95	21.82	40.47	13.53

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Upper bandedge ch 21 (927.1296 MHz) Peak Vert.



Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dB μ V	Ant. Pol	Coax Loss dB	Correction Factor dB/m	Field Strength dB μ V/m	Margin dB
927.1	928.00	14.3	V	1.99	23.17	39.46	14.54

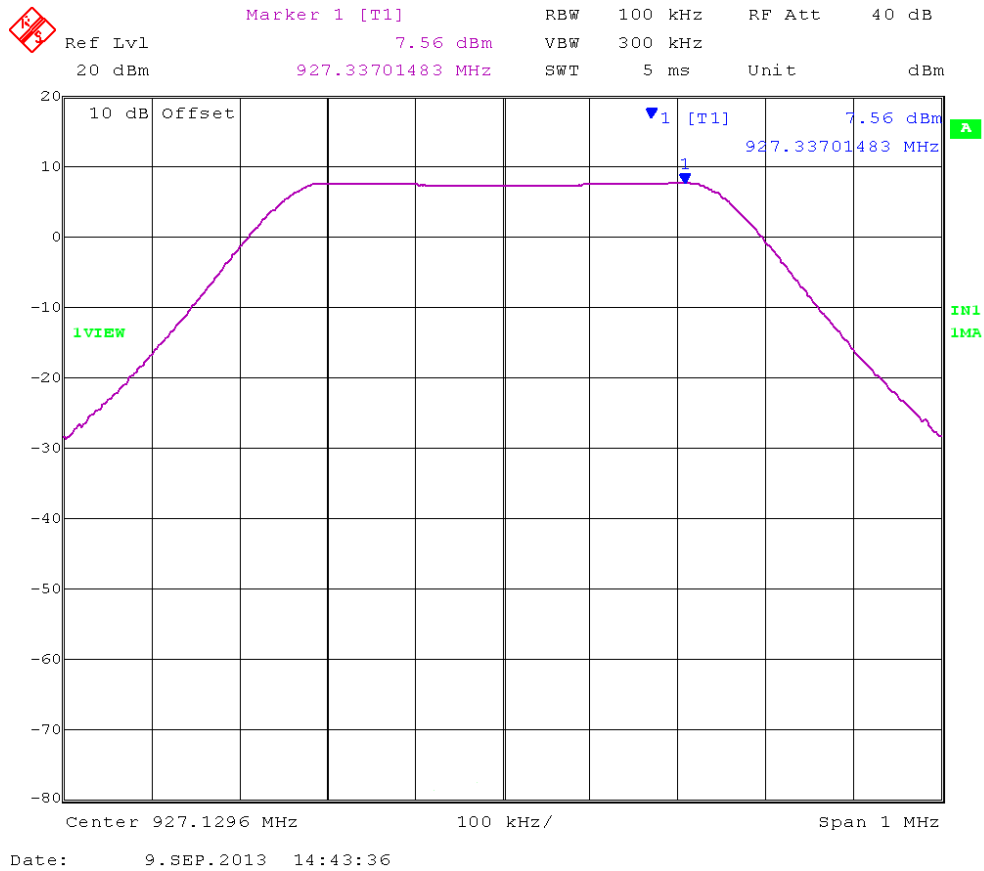
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POWER SPECTRAL DENSITY

Rules Part No.: 15.247(d)

Requirements: The peak level measured must be less than +8.0 dBm.

Test Data: The peak level is 7.56 dBm, with 0 dBi antenna gain.



Three places in the band were measured by conducted method and the worst case reported.

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