

TEST REPORT

Report Number: 3146877MIN-003

Project Number: 3146877

Testing performed on the
T2-Cs Universal Remote Control

FCC ID: MMURTI0900

IC: 3166-RTI0900

to

47 CFR Part 15. 231:2007

RSS- 210, Issue 6, 2007

47 CFR, Part 15.109:2007, Class B

47 CFR, Part 15.107:2007, Class B

ICES 003, Issue 4, 2004

For

Remote Technologies

Test Performed by:
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Oakdale, MN 55128

Test Authorized by:
Remote Technologies
7651 Anagram Drive
Eden Prairie, MN 55344

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Date: March 26, 2008

Reviewed by: 
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Date: March 26, 2008

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1.0 DESCRIPTION OF THE SAMPLE (EUT)

Model:	T2-Cs
Type of EUT:	Universal Remote Control
Serial Number:	n/a
Company:	Remote Technologies
Customer:	Mr. Paul Weichelt
Address:	7651 Anagram Drive Eden Prairie, MN 55344
Phone:	(952) 253-3113
Fax:	(952) 253-3131
Standards Information:	☒ FCC Part 15. 231 ☒ RSS – 210, Issue 6, 2007 ☒ ICES-003, Issue 4, 2004 ☒ 47 CFR, Part 15:2007, §15.109, §15.107, Class B
Operating Frequency Range(s):	Range: 433.86MHz
Type of Modulation:	☒ FSK
Antenna(s) Info:	☒ Antenna Type Integrated
Type of equipment:	☒ Stand -alone ☐ Module ☐ Hybrid
Emission Designator:	67K1K0D
Date Sample Submitted:	March 20, 2008
Test Work Started:	March 20, 2008
Test Work Completed:	March 25, 2008
Test Sample Conditions:	☐ Damaged ☐ Poor (Usable) ☒ Good
Special Test Arrangement:	As a hand-held device the EUT was rotated through three orthogonal axes to determine and tested with the maximum emissions
Test Facility Accreditation:	A2LA (Certificate No. 1427.01)
Test Methodology:	Measurements performed according to the procedures in ANSI C63.4-2003

1.1 Transmitter Power Configuration

Transmitter power configuration:	☒ Internal battery	☒ External power source
	☒ 120VAC for Docking Station	☐ 230VAC ☐ 400VAC ☒ 3.6 VDC Internal
	Lithium Battery for T2-Cs Remote Control ☐ Other:	
	Amp.	
	☐ 50Hz	☒ 60Hz

1.2 EUT Configuration

The equipment under test was operated during the measurement under the following conditions:

- ☐ - Standby
- ☐ - Continuous
- ☐ - Continuous un-modulated
- ☐ - Test program (customer specific)
- ☒ - See below

Operating modes of the EUT:

No.	Description
1	The transmitter was wired to transmit continuously.
2	Docking Station was tested in charging mode.

Cables:

No.	Type	Length	Designation	Note
1	none			
2				

Support equipment/Services:

No.	Item	Description
1	none	
2		

General notes: Internal USB port. The USB port is only used to download software (by an RTI dealer). Therefore, USB cable was not connected to the T2-Cs remote control during testing.

1.3 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

☐ Normal

Temperature: 15-35 ° C

Humidity: 30-60 %

Atmospheric pressure: 86-106 kPa

1.4 Measurement uncertainty

The expanded uncertainty ($k = 2$) for radiated emissions from 30 to 1000 MHz has been determined to be: ± 4 dB at 10m and ± 5.4 dB at 3m

The expanded uncertainty ($k = 2$) for conducted emissions from 150 kHz to 30 MHz has been determined to be:

± 2.6 dB

1.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured emissions reading on the EMI Receiver.

The basic equation with a sample calculation is as follows:

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

Where: FS = Field Strength in dB(μ V/m)

RA = Receiver Amplitude in dB(μ V)

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB(m^{-1})

AG = Amplifier Gain in dB

Assume a receiver reading of 48.1 dB(μ V) is obtained. The antenna factor of 7.4 dB(m^{-1}) and cable factor of 1.6 dB is added and amplifier gain of 16.0 dB is subtracted giving field strength of 41.1 dB(μ V/m).

$$RA = 48.1 \text{ dB}(\mu\text{V})$$

$$AF = 7.4 \text{ dB}(m^{-1})$$

$$CF = 1.6 \text{ dB}$$

$$AG = 16.0 \text{ dB}$$

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

$$FS = 48.1 + 7.4 + 1.6 - 16.0$$

$$FS = 41.1 \text{ dB}(\mu\text{V}/\text{m})$$

General notes:

2.0 TEST SUMMARY

Referring to the performance criteria and the operating mode during the tests specified in this report, the equipment complies with the requirements according to the following standards.

TEST SPECIFICATION	TEST PARAMETERS	RESULT
15.231(a) / RSS-210 A1.1.1(a)	Transmitter deactivation time	Pass
15.231(b) / RSS-210 A1.1.2	Transmitter field strength of emissions	Pass
15.231(c) / RSS-210 A1.1.3	Bandwidth of the emission	Pass
15.207/RSS-Gen 7.2.2	Transmitter Power Line conducted emissions	N/A
15.109/ICES-003	Digital device radiated emissions	Pass
15.107/ ICES-003	Digital device conducted emissions	Pass

Note: The T2-Cs Remote Control Transmitter is battery operated device, therefore Line Conducted Emissions testing is inappropriate and therefore unnecessary. Line Conducted Emissions test was performed on the Universal Controller Docking Station with RTI power adapter AB1206LC.

3.0 TEST CONDITIONS AND RESULTS

3.1 Transmitter deactivation time

Maximum allowed deactivation time: 5 sec

Test result: Pass

The transmitter transmitted continuously while the activation button was pressed. According to FCC Part 15.231(a)(1) a manually operated transmitter should stop transmitting within 5 sec after release the activation button. The transmitter was deactivates automatically less then 1 sec after releasing the activation button.

Notes:



3.2 Transmitter field strength of emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test distance: ☐ 10 meters ☒ 3 meters

Frequency range of measurements: 30MHz-4500MHz

Test result: **Pass**

Max. Emissions margin at fundamental: 0.8 dB below the limits

Max. margin of harmonics and spurious emissions: 36.3 dB below the limits

Notes: None

Date:	March 24, 2008	Result: Pass
Standard:	FCC Part 15. 231(b)	
Tested by:	Uri Spector	
Operation mode:	See page 6	
Note:	Field Strength of Fundamental and Spurious Emissions measurements were made at Fundamental frequency of 433.86MHz; Spurious Emissions were tested up to 4.5GHz (10 th harmonic). The Table 1 shows the Field Strength of Fundamental Radiation. Graphs 1, 2, 3, 4 show calculation of the Average Value Factor. The Table 2 shows Field Strength of Spurious Emissions for T2-Cs Remote Control.	

Table # 1

Frequency MHz	Antenna		Ant. CF dB1/m	Cable loss dB	Pre-amp Gain (dB)	Reading dBμV	Avg Value dB	Total @ 3m dBμV/m	Limit dBμV/m	Margin dB	Comments
	Polarity	Hts(cm)									
433.86	V	118	16.6	2.4	0.0	71.0	0.00	90.0	100.8	-10.8	1
433.86	H	154	16.6	2.4	0.0	61.4	0.00	80.4	100.8	-20.4	1
433.86	V	118	16.6	2.4	0.0	71.0	10.08	80.0	80.8	-0.8	2
433.86	H	154	16.6	2.4	0.0	61.4	10.08	70.3	80.8	-10.5	2

Comments:

1. Peak readings compared to Peak limits
2. Average value readings compared to Average limits

Table # 2

Frequency MHz	Antenna		Ant. CF dB1/m	Cable loss dB	Pre-amp Gain (dB)	PeakReading dBμV	Total @ 3m dBμV/m	Limit dBμV/m	Margin dB	Comments
	Polarity	Hts(cm)								
867.72	V	100	20.7	3.6	0.0	19.0	43.3	N/A	N/A	1
867.72	H	215	20.7	3.6	0.0	17.7	42.0	N/A	N/A	1
1301.58	V	100	24.3	2.4	39.6	37.4	24.5	60.8	-36.3	
1301.58	H	100	24.3	2.4	39.6	33.3	20.4	60.8	-40.4	
1735.44	V	100	26.6	2.7	39.0	36.8	27.1	N/A	N/A	1
1735.44	H	100	26.6	2.7	39.0	30.8	21.1	N/A	N/A	1
1854.00	V	100	27.0	2.8	38.8	38.3	29.3	N/A	N/A	1
1854.00	H	100	27.0	2.8	38.8	29.8	20.8	N/A	N/A	1

Comments: Frequency outside restricted bands of operation per 15.205

3.2.1 Average correction factor calculation

Calculation of the Average Value Factor:

Average Factor= $20\text{Log}(\text{On air/Pulse Train})=20\text{Log}(4*0.780)+(67*0.330)/80.56=20\text{Log}0.313=-10.08\text{dB}$

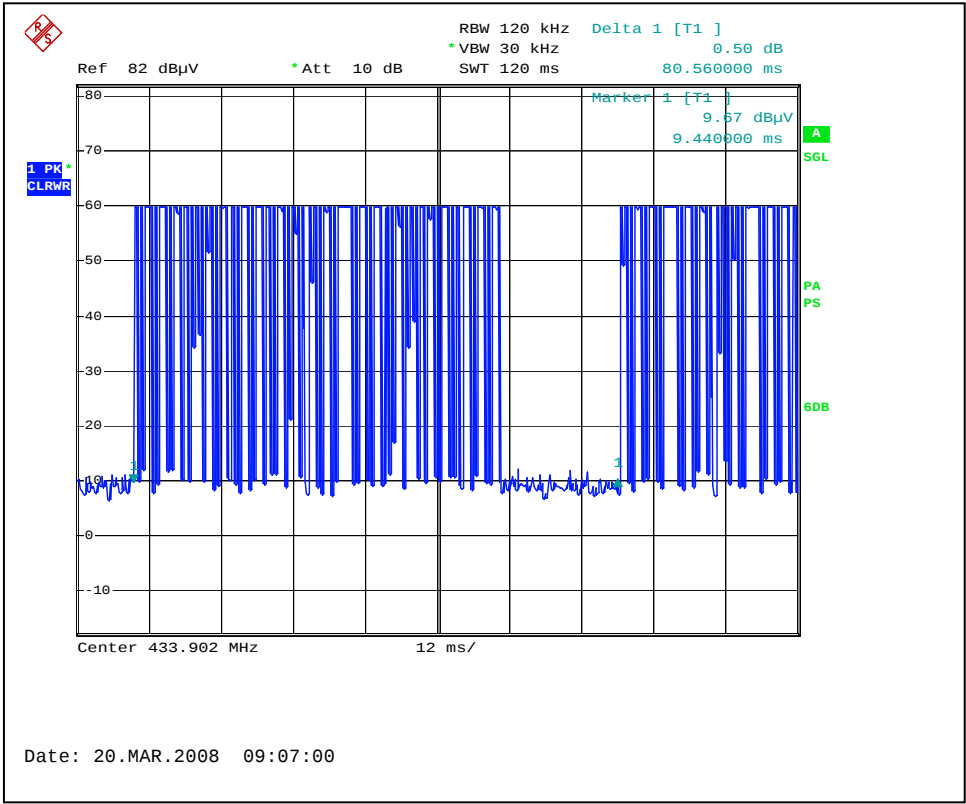
Pulse train=80.56msec (see Graph 1)

“Wide pulses”: 4 each of 0.780msec (see Graphs 2, 4)

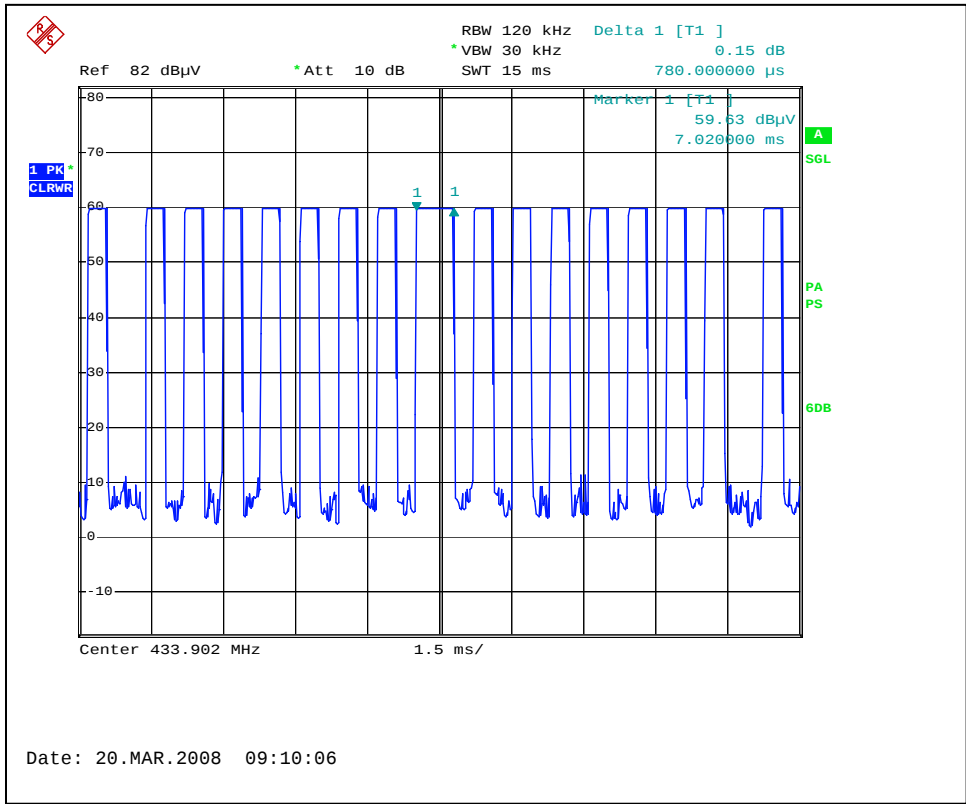
“Regular pulses”: 67 each of 0.330msec (see Graphs 3, 4)

Notes:

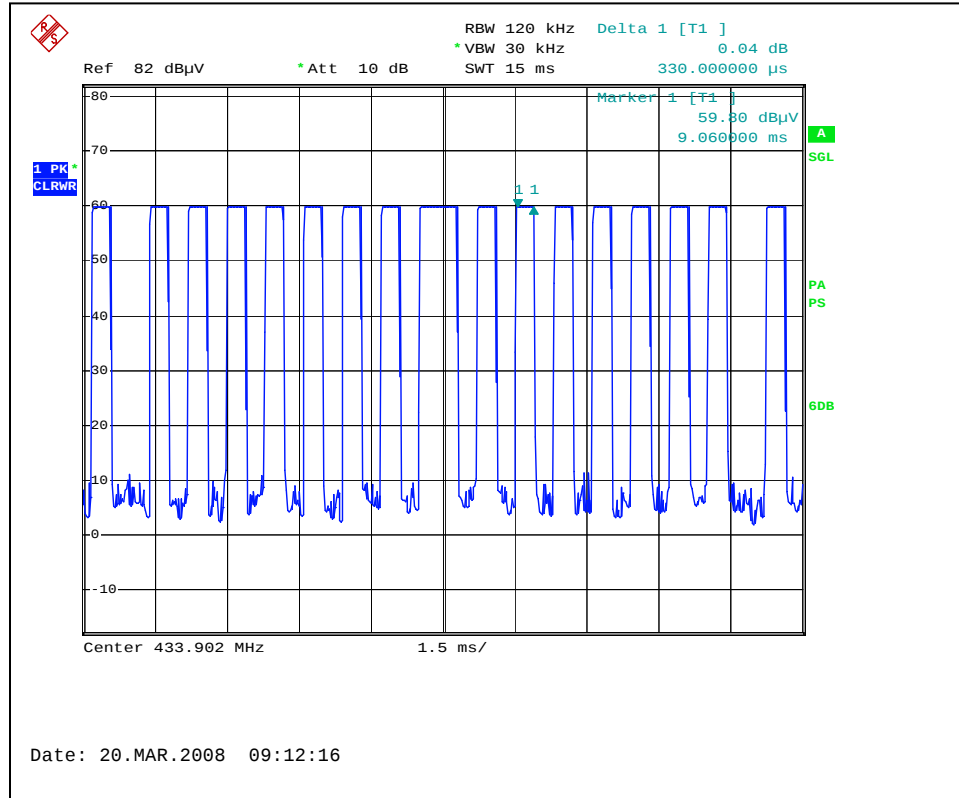
Graph 1



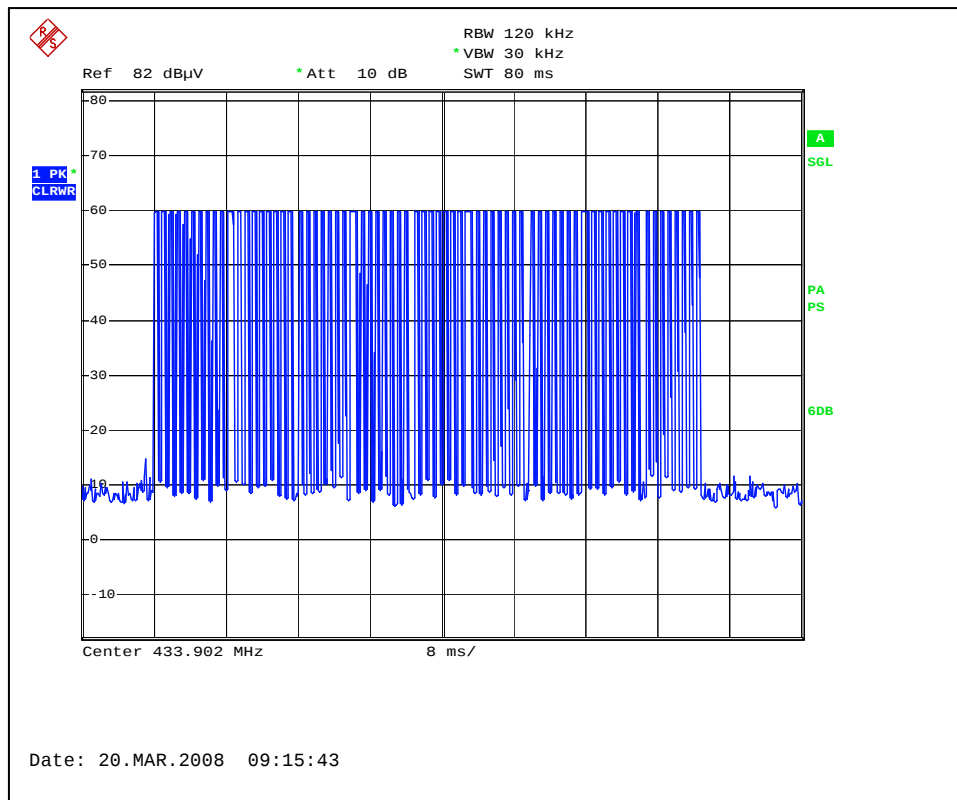
Graph 2



Graph 3



Graph 4

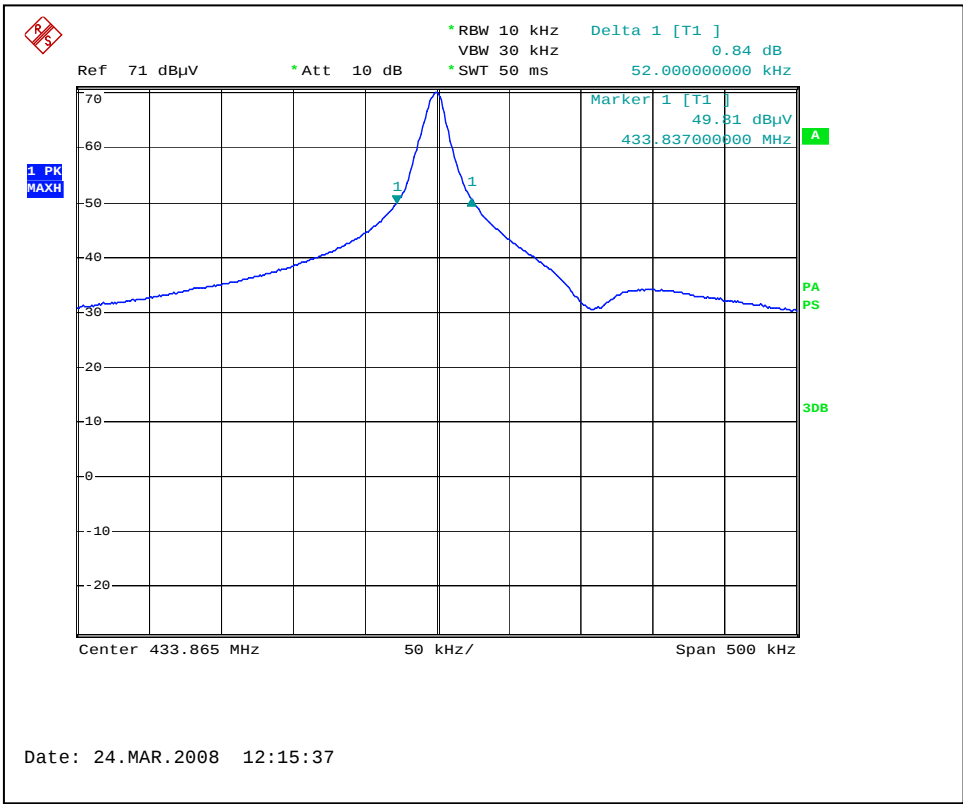


3.3 Bandwidth of Emissions

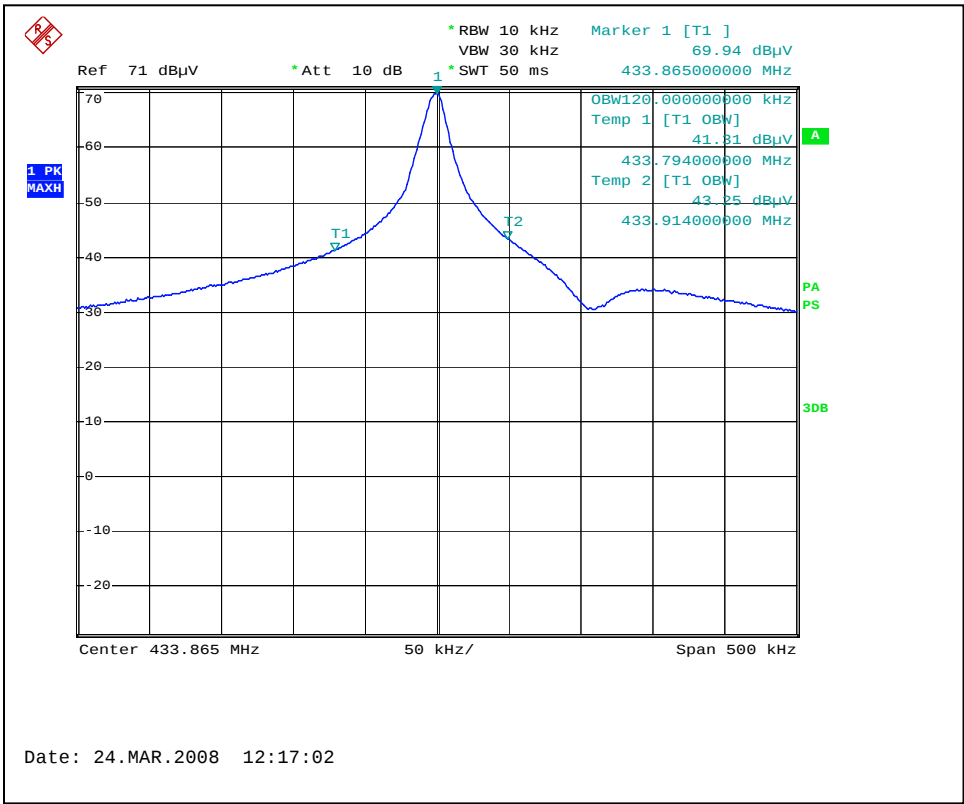
Center Frequency of operation MHz	Maximum allowed bandwidth kHz	Measured 20dB bandwidth kHz	Measured 99% bandwidth kHz	Result
433.86	1084.77	32	120	Pass
Maximum allowed bandwidth:	☒ 0.25% of the centre operating frequency ☐ 0.5% of the centre operating frequency			
RBW:	☒ 10kHz	☐ 100kHz	☐ other	kHz
VBW:	☒ 30kHz	☐ 300kHz	☐ other	kHz

Notes: The Graph 5 shows the Bandwidth of Emissions at –20dB level.
 The Graph 6 shows the Bandwidth of Emissions at 99% power.

Graph 5



Graph 6



3.4 Digital device radiated emissions

Description of the test location

Test location: ☐ OATS ☒ Anechoric Chamber

Test distance: ☐ 10 meters ☒ 3 meters

Test result: **Pass**

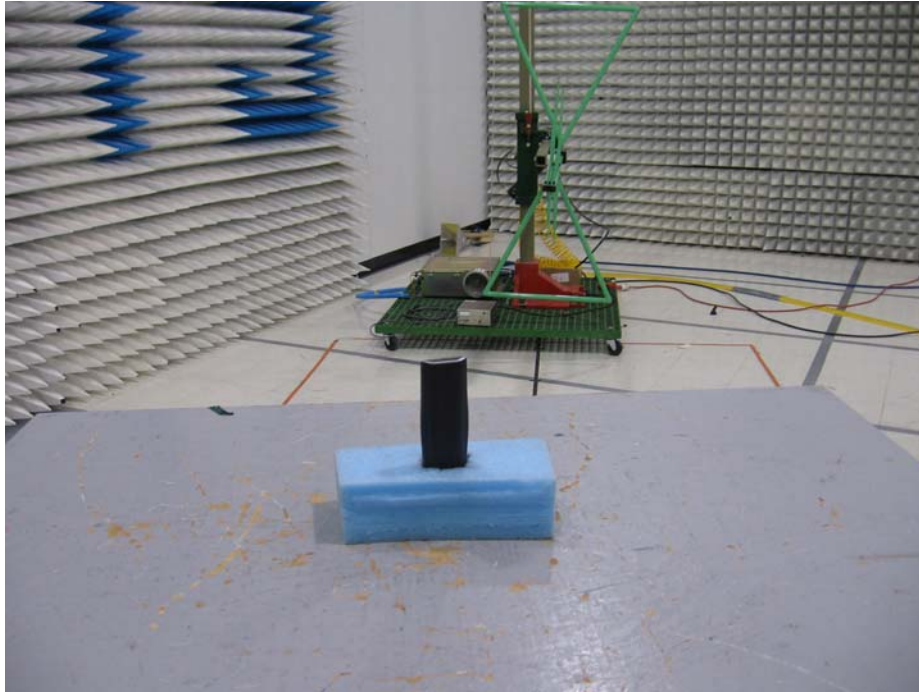
Frequency range: 30MHz-2000MHz for T2-Cs Remote Control
30MHz-1000MHz for Docking Station

Max. Emissions margin: 7.8 dB below the limit for T2-Cs Remote Control
4.4 dB below the limit for Docking Station

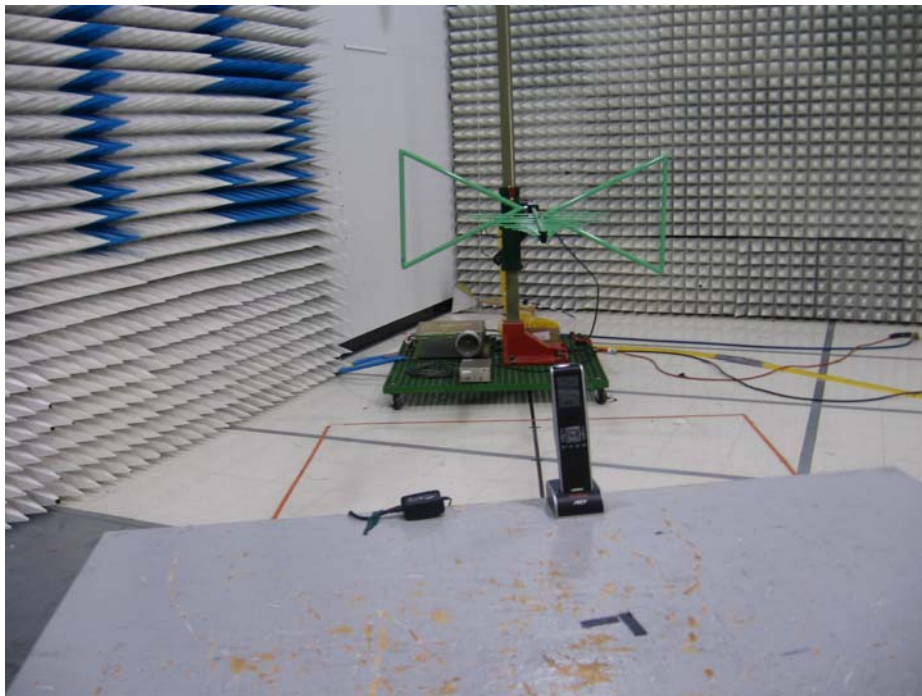
Notes: The EUT (T2-Cs Remote Control) as a digital device was tested according to FCC Part 15.109, Class B in frequency range from 30MHz to 2GHz; emissions at transmitter fundamental frequency and 2nd harmonic were excluded from the Table.

The T2-Cs Remote Control is battery operated device, therefore Line Conducted Emissions testing is inappropriate and therefore unnecessary.

The EUT (Universal Controller Docking Station with power adapter AB1206LC) was tested according to FCC Part 15.109, Class B (frequency range from 30MHz to 1GHz).



Test Setup Photos



Test Setup Photos

Date:	March 24, 2008	Result: Pass
Standard:	FCC Part 15.109, Class B	
Tested by:	Uri Spector	
Test Point:	Enclosure	
Operation mode:	See Page 6	
Note:	T2-CS Remote Control	

Table # 3

Frequency MHz	Antenna		Ant. CF dB1/m	Cable loss dB	Pre-amp Gain (dB)	QP Reading dBμV	Total @ 3m dBμV/m	Limit dBμV/m	Margin dB	Comments
	Polarity	Hts(cm)								
183.93	V	100	9.4	1.6	0.0	24.8	35.8	43.5	-7.8	
256.00	V	162	13.2	1.8	0.0	12.5	27.5	46.0	-18.6	
299.00	V	166	13.6	2.0	0.0	19.2	34.7	46.0	-11.3	
348.30	V	150	14.7	2.1	0.0	15.2	32.1	46.0	-13.9	
425.71	V	120	16.5	2.4	0.0	14.8	33.7	46.0	-12.3	
443.38	V	100	16.8	2.4	0.0	16.7	35.9	46.0	-10.1	
473.91	V	100	17.2	2.5	0.0	13.9	33.6	46.0	-12.4	

Table # 4

Frequency MHz	Antenna Polarity	Peak Reading dBμV	Total C.F. dB1/m	Pre-Amp. Gain (dB)	Total at 3m dBμV/m	QP Limit dBμV/m	Margin dB
1.0373 GHz	V	39.3	26.9	39.8	26.4	54.0	-27.6
1.05 GHz	V	39.7	27.0	39.8	26.9	54.0	-27.0
1.1433 GHz	V	39.4	27.3	39.7	27.0	54.0	-27.0
1.2313 GHz	V	37.7	27.5	39.6	25.6	54.0	-28.4
1.2447 GHz	V	40.1	27.5	39.6	28.0	54.0	-26.0
1.252 GHz	V	40.3	27.5	39.6	28.2	54.0	-25.8
1.3033 GHz	V	40.3	27.7	39.6	28.4	54.0	-25.6
1.3093 GHz	V	39.5	27.7	39.6	27.6	54.0	-26.4
1.3393 GHz	V	40.9	27.8	39.5	29.1	54.0	-24.8
1.394 GHz	V	37.6	27.9	39.5	26.0	54.0	-28.0
1.436 GHz	V	38.6	28.0	39.5	27.2	54.0	-26.8
1.456 GHz	V	39.2	28.1	39.4	27.9	54.0	-26.1
1.7367 GHz	V	38.7	29.3	39.0	29.0	54.0	-25.0
1.8427 GHz	V	36.9	29.8	38.9	27.8	54.0	-26.2

Date:	March 20, 2008	Result: Pass
Standard:	FCC Part 15.109, Class B	
Tested by:	Uri Spector	
Test Point:	Enclosure	
Operation mode:	See Page 6	
Note:	Universal Controller Docking Station with power adapter AB1206LC	

Table # 5

Frequency	Ant. Polarity	Peak Reading dBμV	Ant.Factor dB1/m	Total at 3m dBμV/m	QP Limit dBμV/m	Margin dB
31.588 MHz	V	*12.7	19.7	32.4	40.0	-7.6
40.46 MHz	V	20.6	15.0	35.6	40.0	-4.4
57.417 MHz	V	27.2	8.1	35.3	40.0	-4.7
212.82 MHz	V	21.6	11.5	33.1	43.5	-10.4
224.64 MHz	V	24.1	11.9	36.0	46.0	-10.1
225.42 MHz	V	20.1	12.0	32.1	46.0	-14.0
227.0 MHz	V	23.8	12.1	35.9	46.0	-10.1
229.62 MHz	V	23.5	12.4	35.9	46.0	-10.2
230.94 MHz	V	21.9	12.5	34.5	46.0	-11.6
231.99 MHz	V	21.7	12.6	34.4	46.0	-11.7
233.83 MHz	V	22.7	12.8	35.5	46.0	-10.5
237.76 MHz	V	19.6	13.2	32.8	46.0	-13.2
238.82 MHz	V	19.7	13.3	33.0	46.0	-13.1
242.23 MHz	V	19.1	13.6	32.7	46.0	-13.3
244.33 MHz	V	20.0	13.8	33.9	46.0	-12.2
250.89 MHz	V	20.6	14.5	35.0	46.0	-11.0
256.15 MHz	V	18.0	15.0	32.9	46.0	-13.1
260.61 MHz	V	16.5	15.4	31.9	46.0	-14.1
272.95 MHz	V	17.9	15.3	33.2	46.0	-12.9
31.728 MHz	H	13.4	19.6	33.1	40.0	-6.9
57.251 MHz	H	17.8	8.1	25.9	40.0	-14.1
151.28 MHz	H	13.7	12.6	26.3	43.5	-17.2
207.3 MHz	H	16.3	11.4	27.7	43.5	-15.8
209.67 MHz	H	16.3	11.5	27.8	43.5	-15.8
214.13 MHz	H	16.8	11.5	28.3	43.5	-15.2
217.28 MHz	H	17.6	11.6	29.1	46.0	-16.9
218.6 MHz	H	17.9	11.6	29.4	46.0	-16.6
221.48 MHz	H	19.3	11.6	30.9	46.0	-15.2
224.37 MHz	H	20.1	11.9	31.9	46.0	-14.1
225.69 MHz	H	20.5	12.0	32.5	46.0	-13.5
227.26 MHz	H	21.3	12.2	33.5	46.0	-12.6
229.1 MHz	H	19.5	12.3	31.9	46.0	-14.1
230.94 MHz	H	18.6	12.5	31.1	46.0	-14.9
299.47 MHz	H	17.3	15.6	32.9	46.0	-13.1
307.47 MHz	H	17.6	15.8	33.4	46.0	-12.6
310.74 MHz	H	17.8	15.8	33.7	46.0	-12.4
311.67 MHz	H	17.2	15.9	33.1	46.0	-13.0

Measurements were taken using a Peak detector or CISPR Quasi-peak detector (marked *)



3.5 Digital device conducted emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test result: **Pass**

Frequency range: 0.15MHz-30MHz

Max. Emissions margin: 3.0 dB below the limits

Notes: The EUT (Universal Controller Docking Station with power adapter AB1206LC) was tested according 15.107.



Test Setup Photos

Date:	March 20, 2008	Result: Pass
Standard:	FCC Part 15.107, Class B	
Tested by:	Uri Spector	
Test Point:	Line 1 and Line 2	
Operation mode:	See Page 5	
Note:	Universal Controller Docking Station with power adapter AB1206LC	

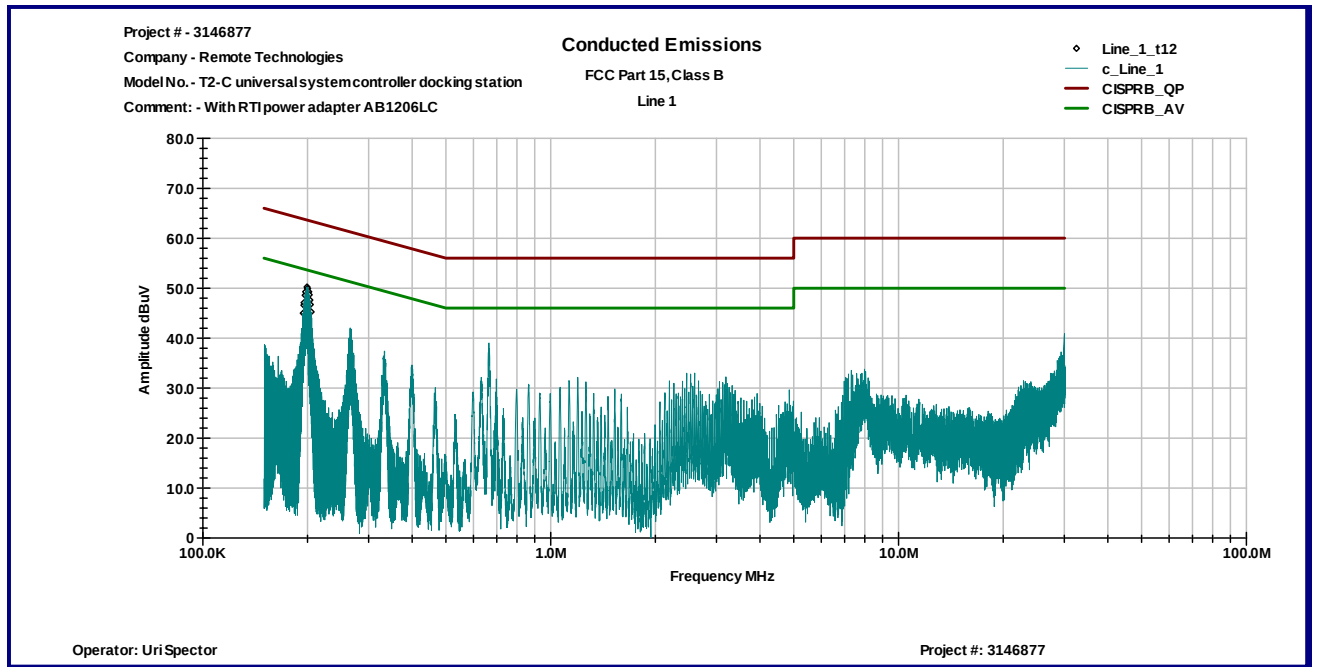
Table # 6

Line 1

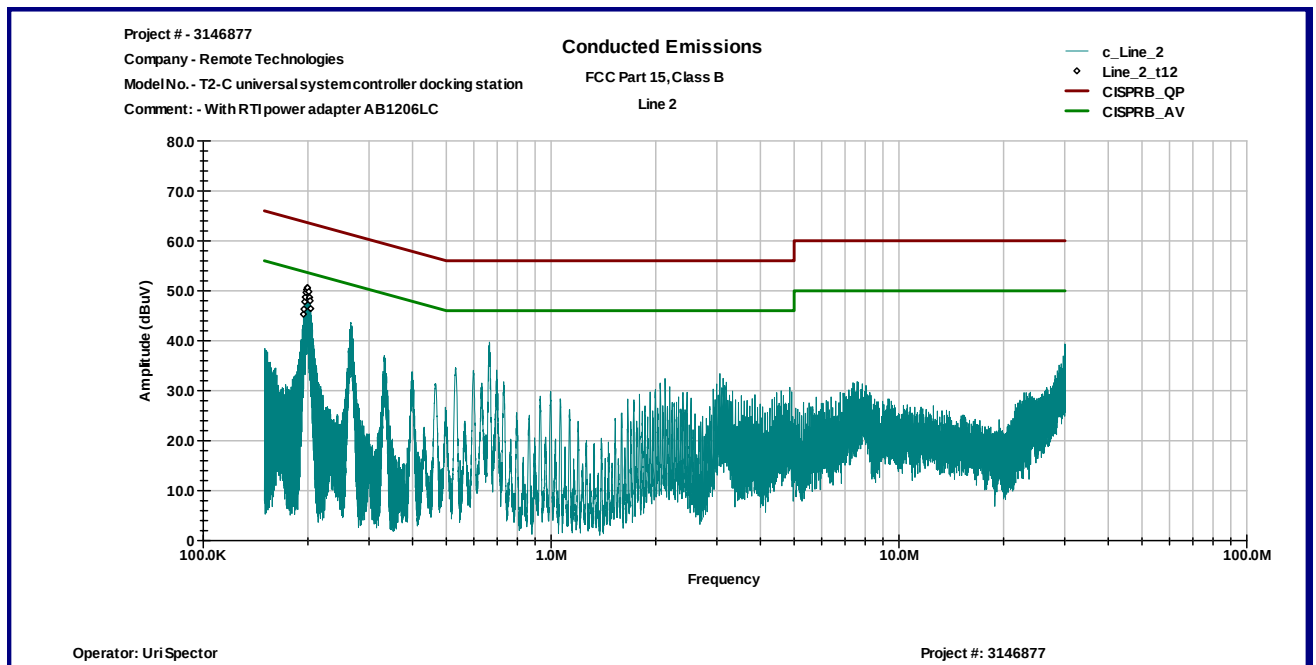
Frequency	Peak dB μ V	QP Limit dB μ V	AVG Limit dB μ V	QP Margin dB	AVG Margin dB
197.64 KHz	49.3	63.7	53.7	-14.4	-4.4
199.3 KHz	50.2	63.6	53.6	-13.4	-3.4
201.55 KHz	49.3	63.6	53.6	-14.3	-4.3
202.24 KHz	48.7	63.5	53.5	-14.8	-4.8
203.21 KHz	47.6	63.5	53.5	-15.9	-5.9
204.88 KHz	45.3	63.4	53.4	-18.2	-8.2

Line 2

Frequency	Peak dB μ V	QP Limit dBmV	AVG Limit dBmV	QP Margin dB	AVG Margin dB
197.54 KHz	49.7	63.7	53.7	-14.1	-4.1
198.32 KHz	50.2	63.7	53.7	-13.4	-3.4
199.6 KHz	50.6	63.6	53.6	-13.0	-3.0
201.26 KHz	49.8	63.6	53.6	-13.8	-3.8
202.92 KHz	48.0	63.5	53.5	-15.5	-5.5
203.8 KHz	46.5	63.5	53.5	-17.0	-7.0



Graph 7



Graph 8

4.0 TEST EQUIPMENT

Emissions Equipment

DESCRIPTION	MANUFACTURER	MODEL	SERIAL NO.	CAL DUE	USED
Spectrum Analyzer	R & S	FSP 40	100024	08/23/2008	☒
Spectrum Analyzer	R & S	ESCI	100358	04/27/2008	☒
Bicono-Log Antenna	Schaffner-Chase	CBL 6112 B	2468	07/30/2008	☒
Horn Antenna	EMCO	3115	9507-4513	02/13/2009	☒
Pre-Amplifier	MITEQ	AMF-5D-00501800-28-13P	1122951	04/24/2008	☒
System	TILE! Instrument Control		Ver. 3.4.K.29	VBU	☒
LISN	Fischer Custom Communications	FCC-LISN-2	316	09/24/2008	☒

