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# **CERTIFICATION TEST REPORT**

Class II Permissive Change

Report Number:	2012 08215560 FCC
Project Number:	10228654
Nex Number:	215560
Applicant:	MicroPower Technologies 4350 Executive Drive, Suite 325 San Diego, CA 92121
Equipment Under Test (EUT):	WIRELESS DIGITAL CAMERA
Model:	MPT-2500
FCC ID: In Accordance With:	ZHX -370-00012-01 FCC Part 15 Subpart C, 15.247
Authorized By:	ANDREAS GILLMEIER, EMC/RF Test Engineer
Tested By:	Nemko USA Inc.
Date:	August 07, 2012
Total Number of Pages:	20

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Section1: Summary of Test Results

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#### 1.1 General

All measurements are traceable to national standards

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 15; Subpart C. Radiated tests were conducted is accordance with ANSI C63.4-2003. Radiated emissions are made in a 10 meter semi-anechoic chamber. A description of the test facility is on file with the FCC.

The assessment summary is as follows:

Apparatus Assessed: Wireless Digital Camera

Model: MPT-2500

Specification: FCC Part 15 Subpart C, 15.247

Date Received in Laboratory: August 02, 2012

Compliance Status: Complies

Exclusions: None

Non-compliances: None

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## 1.2 Report Release History

Revision	Date	Comments	
-	August 07, 2012	Prepared By:	Andreas Gillmeier
-	August 07, 2012	Initial Release:	Alan Laudani

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025.

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**TESTED BY:** 

Date: August 07, 2012

ANDREAS GILLMEIER, EMC Test Engineer

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## Section 2: Equipment Under Test

#### 2.1 Product Identification

The Equipment Under Test was identified as follows:

DEVICE	MANUFACTURER MODEL # SERIAL #	POWER CABLE
EUT - Wireless Digital	MicroPower Technologies	NA
Camera Camera	Model: MPT-2500	
	Serial #: 001	
EUT – Directional Antenna	ANTENNA FACTOR	N/A
	Model: ANT-DB1-LP-RM-01-N	
	Serial: ANT0711230088	
EUT – RF Combiner	Mini-Circuits	N/A
	Model: ZX10-2-252-S+	
	Serial: N/A	

CONNECTION	I/O CABLE
EUT Hub to RF combiner and then to Yagi Antenna	3 x 9" LMR100 cable with SMA connector on each end

## 2.2 Theory of Operation

The MPT-2500 is a Wireless Digital Camera. Control commands communicate through the 902 to 928 MHz band radio and the Camera Data communicate through the 2400 to 2483.5 MHz band radio. The camera MPT-2500 is powered by a battery charged by Solar panels.

The EUT's performance during test was evaluated against the performance criterion specified by applicable test standards. Performance results are detailed in the test results section of this report.

This test report is for the MPT-2500 Camera section of the system. The camera's transmitters were set into a test mode for testing.

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## 2.3 Technical Specifications of the EUT

Manufacturer: MicroPower Technologies

Operating Frequencies: 904.999 MHz to 921.795 MHz

in the 902 -928 MHz Band

and

2412.0 MHz to 2462.0 MHz in the 2400 -2483.5 MHz Band

Rated Power: Low band: 0.034 W

High band: 0.706 W

Modulation: Low band: GFSK,

High band: Digital

Antenna Connector: Type N, professionally installed

Type "Reverse SMA", professionally installed.

Power Source: 3 solar panels, 6 VDC battery

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## Section 3: Test Conditions

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## 3.1 Specifications

The apparatus was assessed against the following specifications:

FCC Part 15 Subpart C, 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5850 MHz and 24.0-24.25 GHz bands.

#### 3.3 Test Environment

All tests were performed under the following environmental conditions:

Temperature range 23 - 24 °C Humidity range 55 - 72 %

Pressure range 100.6 – 100.8 kPa Power supply range 6VDC nominal

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## 3.4 Test Equipment

Nemko ID	Device	Manufacturer	Model	Serial Number	Cal Date	Cal Due Date
E1018	9kHz to 7GHz Spectrum Analyzer	Rohde & Schwarz	FSP7	835363/00 03	02/23/2012	02/23/2013
110	Antenna, LPA	Electrometrics	LPA-25	1217	04/01/2011	04/01/2013
128	Antenna, Bicon	EMCO	3104	2882	03/21/2011	03/21/2013
E1029	Preamplifier (20MHz to 18GHz)	A.H. Systems, Inc.	PAM- 0118	343	02/21/2012	02/21/2013
752	Antenna, DRG Horn, .7-18GHz	EMCO	3115	4943	12/02/2010	12/02/2012
N151C	Regulated DC Power Supply	Xantrex	XT 30-2	E0010497 8	N/A	N/A
810	Multimeter	Fluke	111	77820242	04/06/2012	04/06/2013
911	Spectrum Analyzer	Agilent	E4440A	US414212 66	10/27/2011	10/27/2012
N/A	10 dB Medium Power Attenuator	Narda	768-10	N/A	N/A	N/A
911	Spectrum Analyzer	Narda	768-10	N/A	N/A	N/A

Registrations of the 10m Semi-anechoic chamber are on file with the Federal Communications Commission and with Industry Canada under Site Number 2040B-3.

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### Section 4: Observations

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## 4.1 Modifications Performed During Assessment

No modifications were performed during assessment.

#### 4.2 Record Of Technical Judgements

No technical judgements were made during the assessment.

### 4.3 EUT Parameters Affecting Compliance

The user of the apparatus could not alter parameters that would affect compliance.

## 4.4 Deviations From Laboratory Test Procedures

No deviations from Laboratory Test Procedure

#### 4.5 Test Deleted

No Tests were deleted from this assessment.

#### 4.6 Additional Observations

There were no additional observations made during this assessment.

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## Section 5: Results Summary

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This section contains the following:

## FCC Part 15 Subpart C:

The column headed "Required" indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

- No: not applicable / not relevant
- Υ Yes: Mandatory i.e. the apparatus shall conform to these tests.
- Not Tested, mandatory but not assessed. (See section 4.4 Test deleted) The results contained in this section are representative of the operation of the apparatus as originally submitted.

#### **Test Results** 5.1

Part 15C	Test Description	Required	Result
15.207 (a)	Conducted Emission Limit	NA	Pass
15.215(c)	20 dB Bandwidth	N*	N/T
15.247(a)(2)	Minimum 6dB RF Bandwidth	Y	Pass
15.247(b)(3)	Peak Output Power	Y	Pass
15.247(d)	Band-edge Compliance of RF Conducted Emissions	Y	Pass
15.247 (d)	Spurious RF Conducted Emissions	N*	N/T
15.247 (d)	Spurious Radiated Emissions	Y	Pass
15.247(e)	Power Spectral Density for Digitally Modulated Devices	N*	N/T

<sup>\*</sup> Permissive change class II; not deemed to be affected by the hardware change and therefore not re-measured.

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## Appendix A: Test Results

#### Power Line Conducted Emissions

15.207(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Fraguency of omission (MLIT)	Conducted	Conducted limit (dBµV)		
Frequency of emission (MHz)	Quasi-peak	Average		
0.15–0.5	66 to 56*	56 to 46*		
0.5–5	56	46		
5–30	60	50		

#### **Test Conditions:**

Sample Number:	MPT-2500	Temperature:	N/A °C
Date:		Humidity:	N/A %
Modification State:	Low, Mid and High Channels	Tester:	Andreas Gillmeier
		Laboratory:	

#### Test Results:

EUT does not connect to AC mains.

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#### 20 dB Bandwidth

(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth May otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that May be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

#### **Test Conditions:**

Sample Number:	MPT-2500	Temperature:	N/A°C
Date:		Humidity:	N/A%
Modification State:	Low, Mid and High Channels	Tester:	Andreas Gillmeier
		Laboratory:	

#### Test Results:

Not deemed to be affected by the hardware change and therefore not re-measured.

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#### Minimum 6dB RF Bandwidth

Systems using digital modulation techniques May operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

#### Test Conditions:

Sample Number:	MPT-2500	Temperature:	23 °C
Date:	August 02, 2012	Humidity:	61 %
Modification State:	Low, Mid and High Channels	Tester:	Andreas Gillmeier
		Laboratory:	Nemko

Test Results: EUT complies, See attached plots.

#### Additional Observations:

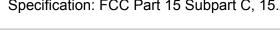
- Only tested in 2400 MHz band as it is required for correction of the measured peak power as the 6dB BW is larger than the largest available RBW on the spectrum analyzer.
- This is a conducted test
- RBW is set to 100kHz
- VBW is 3X RBW
- Sweep is auto
- Detector is Peak
- Trace is Max Hold
- For each RF channel investigated, the spectrum analyser's center frequency was set to the channel carrier. A PEAK output reading was plotted; a DISPLAY line was drawn 6 dB lower than PEAK level. The 6 dB bandwidth was determined from where the channel output spectrum intersected the display line.
- EUT complies as 6 dB BW > 500 kHz

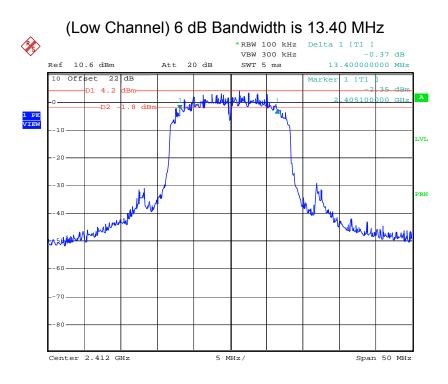
Channel Range	Observed 6 dB bandwidth
Low (904.999 MHz)	Not tested
Mid (914.596 MHz)	Not tested
High (921.795 MHz)	Not tested

Channel Range	Observed 6 dB bandwidth
Low (2412.0 MHz)	13.40 MHz
Mid (2437.0 MHz)	13.90 MHz
High (2462.0 MHz)	12.90 MHz

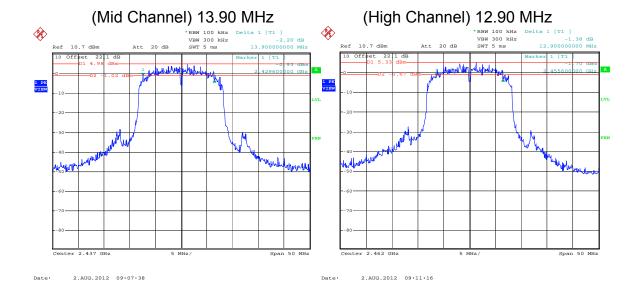
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### Peak Output Power

(3) For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the *maximum conducted output power* is the highest total transmit power occurring in any mode.

#### **Test Conditions:**

Sample Number:	MPT-2500	Temperature:	23°C
Date:	August 02, 2012	Humidity:	61%
Modification State:	Low, Mid and High Channels	Tester:	Andreas Gillmeier
		Laboratory:	Nemko

## Test Results: Table below

#### Additional Observations:

- Only measured on nominal voltage to verify that the output power complies with the rules of a permissive change class II.
- This is a conducted test. 21 dB was offset for the attenuator and cable used.
- Input voltage to the EUT was monitored by a calibrated multimeter.
- Spectrum Analyser used at Maximum RBW, VBW of 10 MHz. For the upper band, a correction factor
  of 10 x log( measured 6dB BW/10MHz) was added to fully account for the power of the digital
  modulation.
- Detector, Max Hold Peak.

Channel Range	Voltage	Measured OP (dBm)	Watts
Low (904.999 MHz)	6.0 VDC	8.21	0.0066
Mid (914.596 MHz)	6.0 VDC	12.08	0.0161
High (921.795 MHz)	6.0 VDC	9.89	0.0097

Channel Range	Voltage	Measured OP (dBm)	Calculated OP (dBm)	Watts
Low (2412.0 MHz)	6.0 VDC	22.05	23.32	0.2148
Mid (2437.0 MHz)	6.0 VDC	22.88	24.31	0.2698
High (2462.0 MHz)	6.0 VDC	23.25	24.36	0.2726

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## RF Radiated Emissions and Band-edge Compliance

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

#### **Test Conditions:**

Sample Number:	MPT-2500	Temperature:	23 – 24°C
Date:	August 02 and 06, 2012	Humidity:	55 -61 %
Modification State:	Low and High Channels	Tester:	Andreas Gillmeier
		Laboratory:	Nemko

#### Test Results:

See attached radiated emissions table.

#### Additional Observations:

 Only radiated emissions were deemed to be affected by the hardware change and therefore the conducted measurements have not been repeated.

#### Low Band:

- Span is wide enough to capture the peak level of the emission operating on the channel closest to the band edges (Lower and Upper).
- Band edges were measured with quasi-peak detector.
- VBW is 3X RBW
- Sweep is auto.
- Detector is Peak, Trace is Max Hold
- No other emissions were found within 20 dB of the limits.

#### High Band:

- Span is wide enough to capture the peak level of the emission operating on the channel closest to the band edges (Lower and Upper).
- For Lower bandedge (no restricted zone) RBW is 100kHz
- For Lower bandedge, the peak level reading was taken and a display line was drawn 20 dBc below this level, which will be the limit for this test.
- For Upper bandedge (restricted zone) RBW is 1MHz,
- For Upper bandedge Limit is 74 dBuV/m peak @ 3m
- For Upper bandedge Limit is 54 dBuV/m average @ 3m
- VBW is 3X RBW
- Sweep is auto.
- Detector is Peak, Trace is Max Hold
- Average = Peak + Duty Cycle Factor
- No other emissions were found within 20 dB of the limits.

Job #:

NEX#:

Client Name:

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Date : <u>08/02-06/1</u>2 Page <u>1</u> of \_

Staff: AG

MicroPower Technologies EUT Voltage: 6V

 EUT Name :
 Wireless RF Module
 EUT Frequency :
 N/A

 EUT Model # :
 Phase:
 N/A

 EUT Serial # :
 N/A

EUT Config. : TX with test mode Distance < 1000 MHz: 3 m
Distance > 1000 MHz: 3 m

FCC Part 15.247 Specification: Loop Ant. #: NA RBW: 120 kHz Quasi-Peak Bicon Ant.#: 128 3m Temp. (°C): 23-24 Video Bandwidth 300 kHz Humidity (%): Log Ant.#: 110\_3m 55-72 RBW: 1 MHz Peak DRG Ant. # 752 Spec Analyzer #: Video Bandwidth 3 MHz 911 SAC\_10m Cable LF#: Analyzer Display #: 911 Average = Peak + Duty Cycle Factor DCF =  $20 \times \log(\text{duty cyle})$ 

**Radiated Emissions Data** 

 Cable HF#:
 WCC
 Quasi-Peak Detector #:
 911

 Preamp LF#:
 N/A
 Duty Cycle (%):
 16.25
 3.25

 Preamp HF#
 E1029
 Measurements below 10

Measurements below 1 GHz are Quasi-Peak values, unless otherwise stated.

Measurements above 1 GHz are Average values, unless otherwise stated.

			iveasurements above i Grz are Average values, unless otherwise stated.						_	s, uriless offierwise stated.	
Meas.	Meter	Meter	Det.	EUT	Ant.	Max.	Corrected	Spec.	CR/SL	Pass	
Freq.	Reading	Reading		Side	Height	Reading	Reading	limit	Diff.	Fail	
(MHz)	Vertical	Horizontal		DEG	cm	(dBµV)	(dBµV)	(dBµV)	(dB)		Comment
904.799	70.3	78.7	Р	179.0	100.0	78.7	108.3				RBW 3MHz, VBW 8MHz
921.795	71.0	80.3	Р	182.0	100.0	80.3	110.0				RBW 3MHz, VBW 8MHz
902.0	40.9	48.7	Р	179.0	100.0	48.7	78.3	88.3	-10.0	Pass	band edge; limit 20 dBc
928.0	39.8	48.8	Р	182.0	100.0	48.8	78.5	90.0	-11.5	Pass	band edge; limit 20 dBc
2390.0	25.1	28.4	Р	190.0	115.0	28.4	64.9	74.0	-9.1	Pass	band edge restricted
2390.0	25.1	28.4	Α	190.0	115.0	28.4	44.9	54.0	-9.1	Pass	band edge restricted
2400.0	23.6	34.7	Р	190.0	115.0	34.7	71.2	95.8	-24.6	Pass	100k rbw
2400.0	23.6	34.7	Α	190.0	115.0	34.7	51.2	75.8	-24.6	Pass	100k rbw
2412.0	67.8	79.6	Р	190.0	115.0	79.6	116.1				1 MHz RBW
2483.5	24.7	25.9	Р	195.0	111.0	25.9	62.4	74.0	-11.6	Pass	bandedge
2483.5	24.7	25.9	Α	195.0	111.0	25.9	42.4	54.0	-11.6	Pass	bandedge
											Duty cycle limited to -20dB
4824.0	53.6	52.8	Р	362.0	104.0	53.6	52.7	74.0	-21.3	Pass	2.4 GHz band, low channel
4824.0	53.6	52.8	Α	362.0	104.0	53.6	32.7	54.0	-21.3	Pass	2.4 GHz band, low channel
4874.0	50.7	52.0	Р	340.0	101.0	52.0	51.1	74.0	-22.9	Pass	2.4 GHz band, mid channel
4874.0	50.7	52.0	Α			52.0	31.1	54.0	-22.9	Pass	2.4 GHz band, mid channel
7311.0	42.7		Р	13.0	160.0	42.7	47.2	74.0	-26.8	Pass	2.4 GHz band, mid channel
7311.0	42.7		Α	13.0	160.0	42.7	27.2	54.0	-26.8	Pass	2.4 GHz band, mid channel

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4924.0	55.7	55.1	Р	324.0	158.0	55.7	54.8	74.0	-19.2	Pass	2.4 GHz band, high channel
4924.0	55.7	55.1	Α	324.0	158.0	55.7	34.8	54.0	-19.2	Pass	2.4 GHz band, high channel
7386.0	43.4	41.0	Р	356.0	188.0	43.4	47.9	74.0	-26.1	Pass	2.4 GHz band, high channel
7386.0	43.4	41.0	Α	356.0	188.0	43.4	27.9	54.0	-26.1	Pass	2.4 GHz band, high channel
											Duty cycle -15.8dB
1810.0	52.7	57.1	Р	183.0	111.0	57.1	47.0	88.3	-41.3	Pass	900 MHz band, low channel
1810.0	52.7	57.1	Α	183.0	111.0	57.1	31.2	68.3	-37.1	Pass	900 MHz band, low channel
2714.0	53.8	51.9	Р	349.0	100.0	53.8	48.0	74.0	-25.9	Pass	900 MHz band, low channel
2714.0	53.8	51.9	Α	349.0	100.0	53.8	32.3	54.0	-21.7	Pass	900 MHz band, low channel
1829.0	58.6	62.0	Р	182.0	109.0	62.0	51.9	74.0	-22.1	Pass	900 MHz band, mid channel
1829.0	58.6	62.0	Α	182.0	109.0	62.0	36.1	54.0	-17.9	Pass	900 MHz band, mid channel
2744.0	56.4	52.0	Р	352.0	124.0	56.4	50.6	74.0	-23.3	Pass	900 MHz band, mid channel
2744.0	56.4	52.0	Α	352.0	124.0	56.4	34.9	54.0	-19.1	Pass	900 MHz band, mid channel
6400.0	41.0		Р	184.0	109.0	41.0	44.2	74.0	-29.8	Pass	900 MHz band, mid channel
6400.0	41.0		Α	184.0	109.0	41.0	28.4	54.0	-25.6	Pass	900 MHz band, mid channel
1843.0	53.5	60.6	Р	181.0	105.0	60.6	50.5	90.0	-39.5	Pass	900 MHz band, high channe
1843.0	53.5	60.6	Α	181.0	105.0	60.6	34.7	70.0	-35.3	Pass	900 MHz band, high channe
2765.0	53.3	51.0	Р	4.0	104.0	53.3	47.5	74.0	-26.4	Pass	900 MHz band, high channe
2765.0	53.3	51.0	Α	4.0	104.0	53.3	31.8	54.0	-22.2	Pass	900 MHz band, high channe

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#### Spurious RF Conducted Emissions

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

#### **Test Conditions:**

Sample Number:	MPT-2500	Temperature:	N/A °C
Date:		Humidity:	N/A %
Modification State:	Low, Mid and High Channels	Tester:	Andreas Gillmeier
		Laboratory:	

#### Test Results:

Not deemed to be affected by the hardware change and therefore not re-measured.

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Specification: FCC Part 15 Subpart C, 15.247



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## Power Spectral Density for Digitally Modulated Devices

(e) For digitally modulated systems, the 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. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

#### **Test Conditions:**

Sample Number:	MPT-2500	Temperature:	N/A °C
Date:		Humidity:	N/A %
Modification State:	Low, Mid and High Channels	Tester:	Andreas Gillmeier
		Laboratory:	

#### Test Results:

Not deemed to be affected by the hardware change and therefore not re-measured.