PRODUCT SAFETY ENGINEERING, INC.

Testing Certification # 1367-01

TEST REPORT

Model: MT240

For : CPS Products Inc.
: 1010 East 31st Street
: Hialeah, FL 33013

Date Tested : 02/03 - 02/17/ 2010
Test Personnel : David Foerstner

: Test Specifications

FCC Part 15.249	FCC Part 15.203	FCC Part 15.205
FCC Part 15.209	FCC Part 15.212	RSS210 Annex 2. Sec. A2.9

Test Report By : David Foerstner

Approved By : Steven Hoke

Description of non-standard test method or test practice: ***None***

Special limitations of use: ***None***

Traceability: ***reference standards of measurement have been calibrated by a competent body using standards traceable to the NIST.***

According to testing performed at Product Safety Engineering, Inc., the above-mentioned unit is in compliance with the electromagnetic compatibility requirements defined in regulations listed above under specifications. The test results contained herein relate only to the model(s) identified above. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical characteristics.

As the responsible EMC Project Engineer, I hereby declare that the equipment tested as specified above conforms to the requirements indicated above.

Product Description

The product under test is a (2.4) GHz transceiver that operates with either 2-FSK or MSK modulation. The product under test will be used exclusively in CPS products and will not be offered for sale. The test sample was tested in a stand-alone configuration using a SmartRF 04EB Evaluation Board. The host products are always battery powered.

Environmental conditions during testing

The ambient temperature during the testing was within the range of (50° - 104° F).

The humidity levels during the testing was within the range of (10% - 90%) relative humidity

Power supply system : 120 Volts 60 Hz SINGLE phase

Test Results Summary

Test	Requirement	Measured	Pass/Fail	Data Page(s)
Powerline conducted emissions	Table 1	Not applicable	NA	-
Fundamental FS (average)	< 94 dBuV/M	92.7 dBuV/m	Pass	10-15
Fundamental FS (peak)	<114 dBuV/m	97.1 dBuV/m	Pass	10-15
Harmonic FS (average)	< 54 dBuV/m	50.8 dBuV/m	Pass	16
Occupied Bandwidth	None	1.0 MHz	N/A	17

Revision History

Revision	Date	Description
---	02/24/2010	Initial Release
	03/02/2010	rev 1

Test Procedures

All measurements are made in accordance with ANSI C63.4:2003

- ## Powerline conducted interference: 15.207

Requirement - 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 mH/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.

Table 1

Freq. (MHz)	Conducted limit Peak	Conducted limit (QP)
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.

Procedure - Tabletop devices shall be placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the reference groundplane. The vertical conducting plane or wall of a screened room shall be located 40 cm to the rear of the EUT. Floor-standing devices shall be placed either directly on the reference groundplane or on insulating material. All other surfaces of tabletop or floor-standing EUTs shall be at least 80 cm from any other grounded conducting surface, including the case or cases of one or more LISNs. AC powerline adapters that are used with EUTs such as laptop or notebook computers should be placed as typically used, i.e., on the tabletop if the adapter-to-EUT cord is too short to allow the power adapter to reach the floor.

Each current-carrying conductor of the EUT power cord(s), except the ground (safety) conductor(s), shall be individually connected through a LISN to the input power source. All 50 Ω ports of the LISN shall be resistively terminated in 50 Ω when not connected to the measuring instrument. When the test configuration is comprised of multiple units (EUT and associated/peripheral equipment, or EUT consisting of multiple equipment) that have their own power cords, ac powerline conducted emissions measurements shall be performed with the ac powerline cord of the particular unit under test connected to one LISN that is connected to the measuring instrument. Those power cords for the units in the remainder of the configuration not under measurement shall be connected to a LISN different from the LISN used for the power cord of the portion of the EUT being measured. This connection may be made using a multiple receptacle device.

Emissions from each current-carrying conductor of the EUT shall be individually measured. Where multipleportions of the EUT receive ac power from a common power strip, which is furnished by the manufacturer as part of the EUT, measurements need only be made on the current-carrying conductors of the common power strip. Adapters or extension cords connected between the EUT power cord plug and the LISN power receptacle shall be included in the

LISN setup such that the calibration of the combined adapter or extension cord with an adapter and the LISN meets the requirements.

If the EUT is comprised of a number of devices that have their own separate ac power connections, e.g., a floor-standing frame with independent power cords for each shelf, that are able to connect directly to the ac power network, each current-carrying conductor of one device is measured while the other devices are connected to a second (or more) LISN(s). All devices shall be separately measured. If a power strip is provided by the manufacturer, to supply all of the devices making up the EUT, only the conductors in the common power cord to the power strip shall be measured.

If the EUT is normally operated with a ground (safety) connection, the EUT shall be connected to the ground at the LISN through a conductor provided in the lead from the ac power to the LISN. The excess length of the power cord between the EUT and the LISN receptacle (or ac power receptacle where a LISN cannot be used), or an adapter or extension cord connected to and measured with the LISN, shall be folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length. If the EUT does not have a flexible power lead, the EUT shall be placed at a distance of 80 cm from the LISN (or power receptacle where a LISN cannot be used) and connected thereto by a power lead or appropriate connection no more than 1 m long. The measurement shall be made at the LISN end of this power lead or connection.

- **Radiated Emissions:** 15.249, 15.205(a) & RSS210

Requirement - the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following table, as measured with an average detector and when measured with a peak detector must not exceed the average measurement by more than (20) dB.

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

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) shown in the following table:

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100	3
88–216	150	3
216–960	200	3
Above 960	500	3

Procedure - The final open field emission tests were then manually performed over the frequency range of 30MHz to 25GHz.

1) For all emissions in the restricted bands, the following procedure was used:

a) The field strengths of all emissions below 1 GHz were measured using biconical and log periodic antennas. The antennas was positioned at a 3 meter distance from the test item. A peak detector with a resolution bandwidth of 100 kHz was used on the spectrum analyzer.

b) The field strengths of all emissions above 1 GHz were measured using a double-ridged waveguide antenna. The waveguide antenna was positioned at a 3 meter distance from the test item. A peak detector with a resolution bandwidth of 1 MHz was used on the spectrum analyzer.

c) To ensure that maximum or worst case emission levels were measured, the following steps were taken when taking all measurements:

i) The test item was rotated so that all of its sides were exposed to the receiving antenna.

ii) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.

iii) The measuring antenna was raised and lowered for each antenna polarization to maximize the readings.

iv) In instances were it was necessary to use a shortened cable between the measuring antenna and the spectrum analyzer, the measuring antenna was not raised or lowered to ensure maximized readings, instead the test item was rotated through all axis to ensure the maximum readings were recorded for the test item.

d) For all radiated emissions measurements below 1 GHz, if the peak reading is below the limits listed in 15.209(a), no further measurements are required. If however, the peak readings exceed the limits listed in 15.209(a), then the emissions are re-measured using a quasi-peak detector.

e) For all radiated emissions measurements above 1 GHz, the peak readings must comply with the 15.35(b) limits. 15.35(b) states that when average radiated emissions measurements are specified, there also is a limit on the peak level of the radiated emissions. The limit on the peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test. Therefore, all peak readings above 1 GHz must be no greater than 20 dB above the limits specified in 15.209(a).

f) Next, for all radiated emissions measurements above 1GHz, the resolution bandwidth was set to 1MHz. The analyzer was set to linear mode with a 10Hz video bandwidth in order to simulate an average detector. An average reading was taken. These readings must be no greater than the limits specified in 15.209(a).

- ## 20 dB Bandwidth:

Procedure - The spectrum analyzer is set to a resolution and video bandwidth far greater than the emission bandwidth and the peak of the signal is set to the top line of the analyzer. The spectrum analyzer is then set as follows;

Span: the minimum span to fully display the emission and approximately 20 dB below the peak level
Resolution BW: Set to 1% to 3% of the approximate emission width
Video BW: 3 times the Resolution BW
Video Averaging: None
Sweep time: Coupled
Detector: Sample

The marker is placed on the trace at the point left of centre that displays a value that is 20 dB below the value of the reference level. The delta marker is evoked and placed at the point to the right of centre that displays 0 dB differential. The frequency differential is the occupied bandwidth.

Test Equipment

Manufacturer	Model	Description	Serial Number	Cal Due
Hewlett Packard	8566B	Spectrum Analyzer	2421A00526	07/07/10
Hewlett Packard	85662A	Display	2403A07352	07/07/10
Hewlett Packard	85650A	Quasi-Peak Adapter	2043A00209	07/07/10
Hewlett Packard	8447D	Preamp 0.1 - 1,000 MHz	2944A06901	10/07/10
Hewlett Packard	8449B	Preamp 1 - 26.5 GHz	3008A00320	01/07/11
EMCO	3104C	Biconical Antenna	00075927	01/21/11
EMCO	3148	Log Periodic Antenna	00075741	08/09/10
EMCO	3115	Double Ridge Guide Ant.	3810	04/08/11
Solar	8028	LISN	829012/809022	03/25/10
Electro-Metrics	EMC-30	EMI Receiver	44191	07/24/10

* Cal Due Date Format = MM/DD/YY
Last calibration date is one year prior to the calibration due dates listed unless otherwise noted.

System Configuration

3.1 General Description

The test item is a 2.4 GHz transceiver, The CPS modular transceiver MT240 is a modular component designed around the Texas Instruments' CC2500 transceiver IC and is intended to serve as the RF link subsystem in a variety of proprietary test and measurement instruments. The MT240 circuitry resides on a 1" x 1.5" (25.4mm x 38mm), 0.062" (1.6mm) thick FR4 PCB and incorporates its own shield. Connection to the module is via a 9 pin male header located at the end opposite the antenna. The MT240 also incorporates its own power regulator circuit which ensures that the RF transceiver chip always operates at its optimum voltage. The module is externally powered by a DC voltage ranging from 4.3 to 14 VDC. The module is intended to operate in portable, battery operated, test and measurement instruments with no connection to the AC mains. The MT240 transceiver module incorporates its own surface mounted chip antenna. No connectors for an external antenna are provided.

3.1.1 Power Input

The test item obtains power from external 4.3 to 14 VDC source.

3.1.2 Peripheral Equipment

The following peripheral equipment was submitted with the test item:

1) Dell notebook computer model

3.1.3 Interconnect Cables

1) USB / shielded / 3 feet

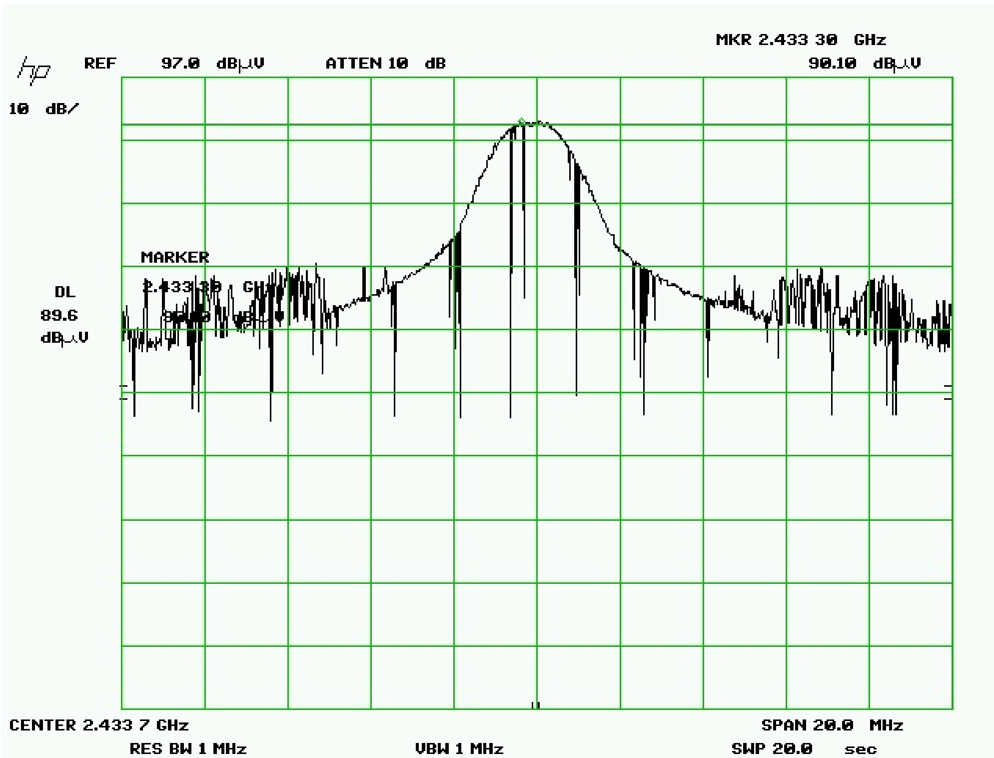
3.1.4 Grounding

The test item was not grounded during the test.

3.2 Operational Mode

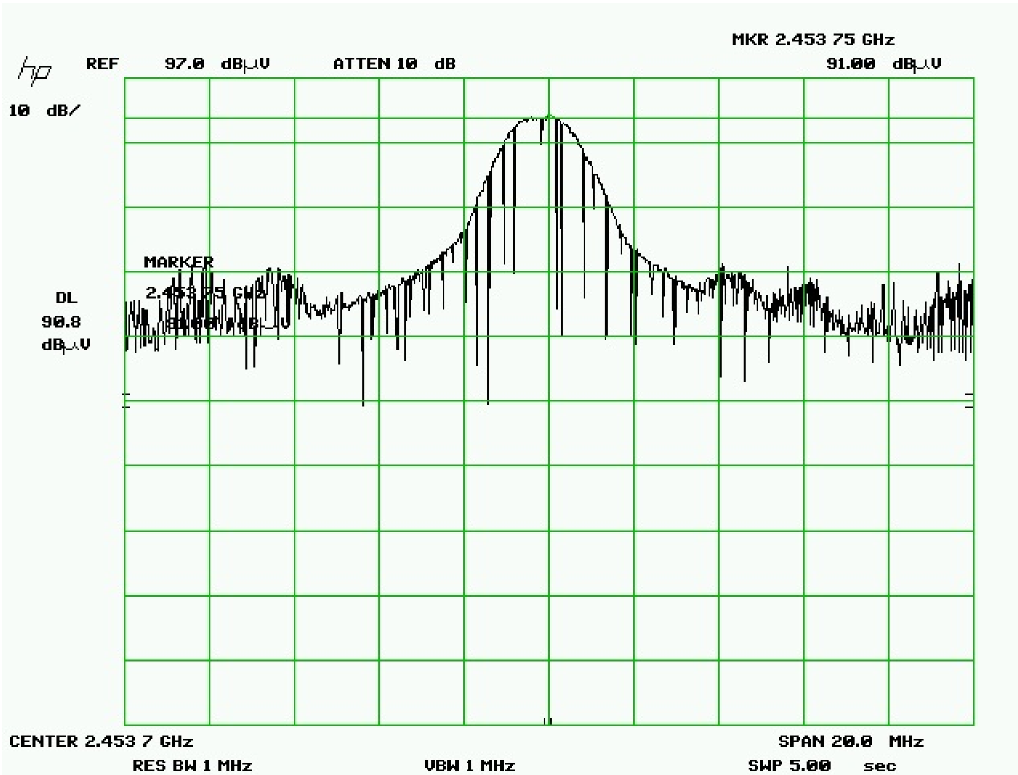
For all radiated tests the test item was placed on an 80cm high non-conductive stand. The test item and all peripheral equipment were energized. Measurements were made using both 2-FSK and MSK modulation.

DATA



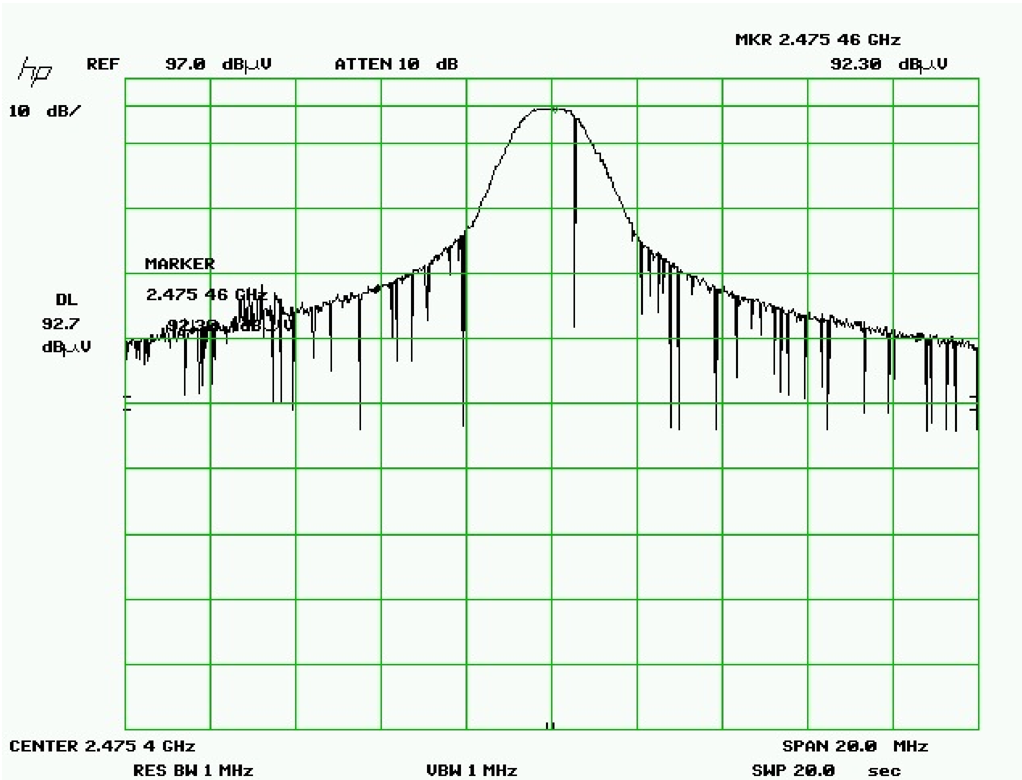
Channel = 3
Frequency = 2.433 GHz
Polarity = Vertical
Modulation / Data Rate = 2-FSK / 2.4 KBaud
Measurement Distance = 3 meters
System Gain (SG) = Preamp Gain - Cable Loss = 22.2 dB @ 2.433 GHz
Antenna Factor (AF) = 26.5 dB/M @ 2.433 GHz
Field Strength (FS) = Lev(dBuV) + AF(dB/M) - SG(dB)
FS (peak) = 90.1 + 26.5 - 22.2 = 94.4 dBuV/M
FS (Average) = 86.2 + 26.5 - 22.2 = 90.5 dBuV/M

FS Limit (Average) = 50 mV/M @ 3 meters = 94 dBuV/M @ 3 meters
Margin = 94.0 - 90.5 = 3.5 dB



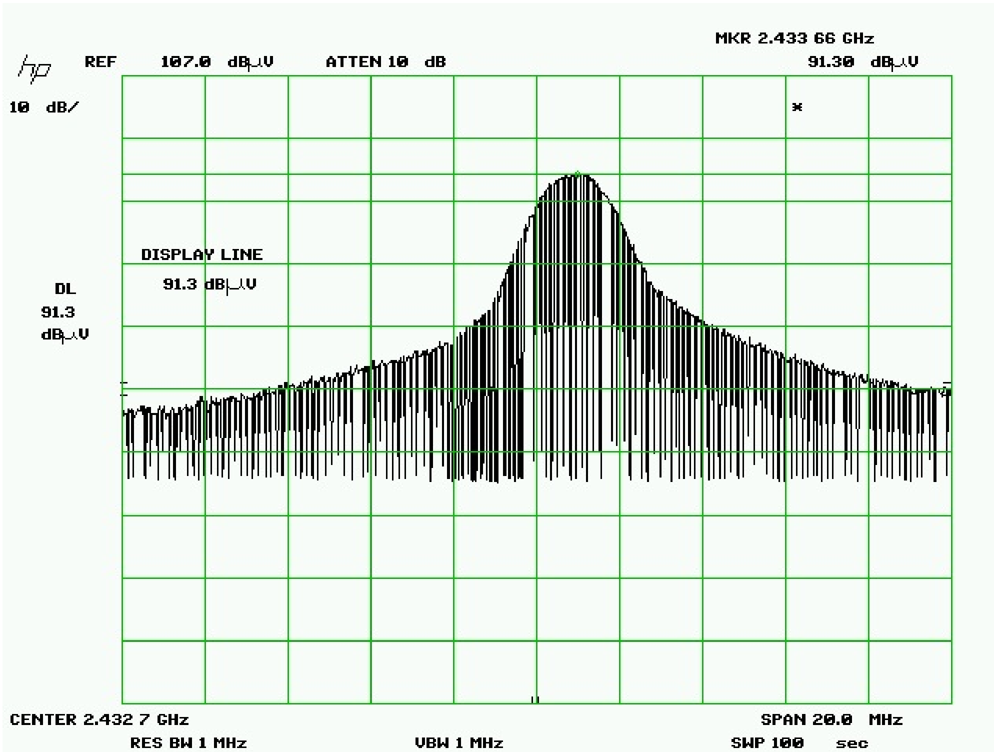
Channel = 103
Frequency = 2.453 GHz
Polarity = Vertical
Modulation / Data Rate = 2-FSK / 2.4 KBaud
Measurement Distance = 3 meters
System Gain (SG) = Preamp Gain - Cable Loss = 22.0 dB @ 2.453 GHz
Antenna Factor (AF) = 26.5 dB/M @ 2.453 GHz
Field Strength (FS) = Lev(dBuV) + AF(dB/M) - SG(dB)
FS (peak) = 91.0 + 26.5 - 22.0 = 95.5 dBuV/M
FS (Average) = 87.4 + 26.5 - 22.0 = 91.9 dBuV/M

FS Limit (Average) = 50 mV/M @ 3 meters = 94 dBuV/M @ 3 meters
Margin = 94.0 - 91.9 = 2.1 dB



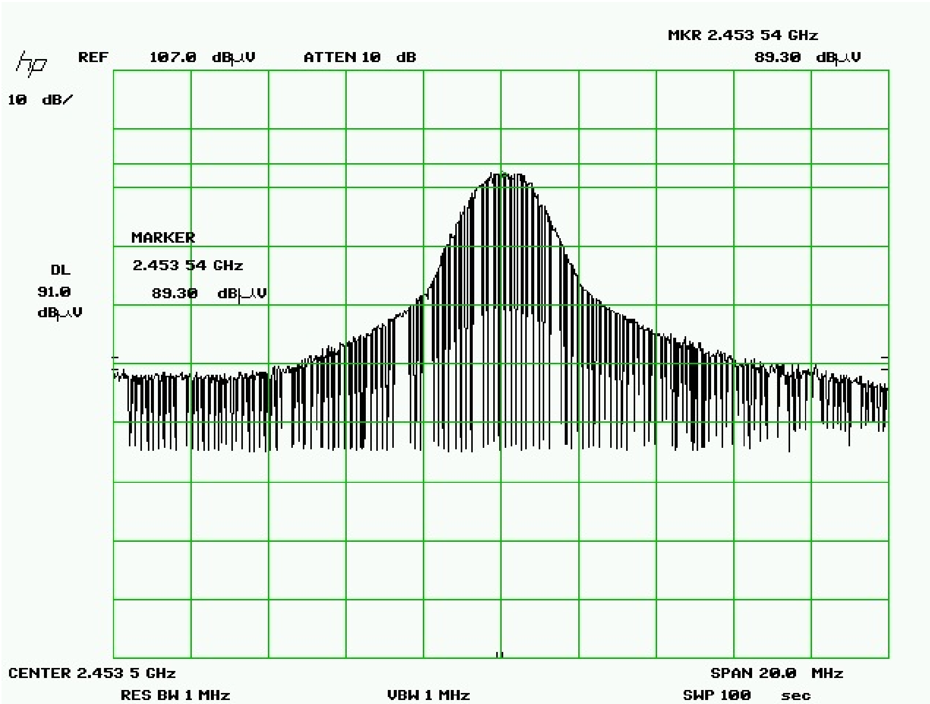
Channel = 212
Frequency = 2.475 GHz
Polarity = Vertical
Modulation / Data Rate = 2-FSK / 2.4 KBaud
Measurement Distance = 3 meters
System Gain (SG) = Preamp Gain - Cable Loss = 21.7 dB @ 2.475 GHz
Antenna Factor (AF) = 26.5 dB/M @ 2.475 GHz
Field Strength (FS) = Lev(dBuV) + AF(dB/M) - SG(dB)
FS (peak) = 92.3 + 26.5 - 21.7 = 97.1 dBuV/M
FS (Average) = 87.9 + 26.5 - 21.7 = 92.7 dBuV/M

FS Limit (Average) = 50 mV/M @ 3 meters = 94 dBuV/M @ 3 meters
Margin = 94.0 - 92.7 = 1.3 dB



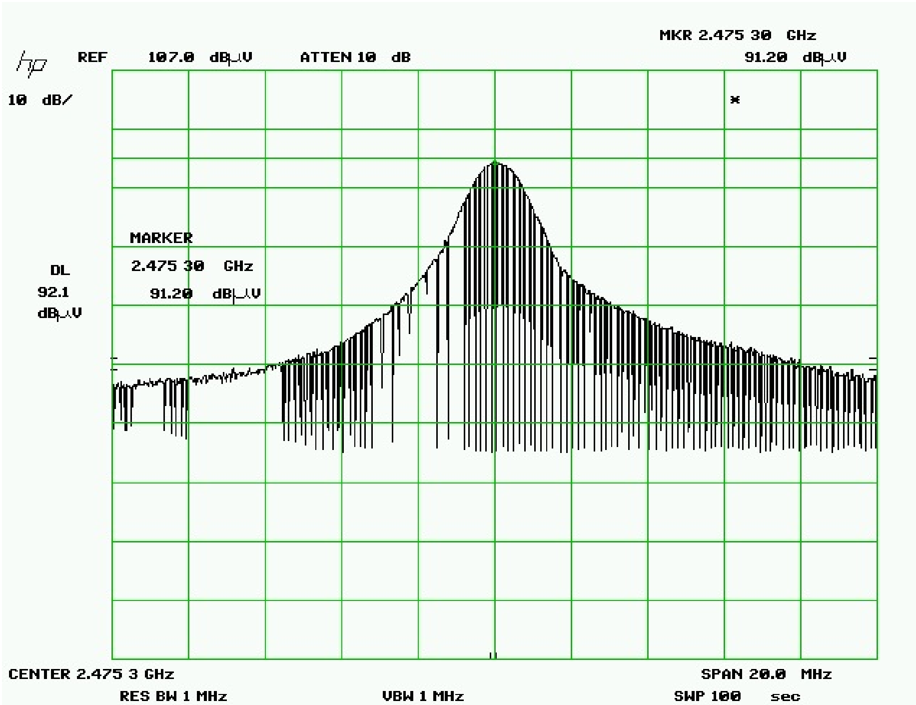
Channel = 3
Frequency = 2.433 GHz
Polarity = Vertical
Modulation / Data Rate = 2-FSK / 2.4 KBaud
Measurement Distance = 3 meters
System Gain (SG) = Preamp Gain - Cable Loss = 22.2 dB @ 2.433 GHz
Antenna Factor (AF) = 26.5 dB/M @ 2.433 GHz
Field Strength (FS) = Lev(dBuV) + AF(dB/M) - SG(dB)
FS (peak) = 91.3 + 26.5 - 22.2 = 95.6 dBuV/M
FS (Average) = 86.2 + 26.5 - 22.2 = 90.5 dBuV/M

FS Limit (Average) = 50 mV/M @ 3 meters = 94 dBuV/M @ 3 meters
Margin = 94.0 - 90.5 = 3.5 dB



Channel = 103
Frequency = 2.453 GHz
Polarity = Vertical
Modulation / Data Rate = MSK / 500 KBaud
Measurement Distance = 3 meters
System Gain (SG) = Preamp Gain - Cable Loss = 22.2 dB @ 2.433 GHz
Antenna Factor (AF) = 26.5 dB/M @ 2.433 GHz
Field Strength (FS) = Lev(dBuV) + AF(dB/M) - SG(dB)
FS (peak) = 89.3 + 26.5 - 22.2 = 93.6 dBuV/M
FS (Average) = 87.4 + 26.5 - 22.0 = 91.9 dBuV/M

FS Limit (Average) = 50 mV/M @ 3 meters = 94 dBuV/M @ 3 meters
Margin = 94.0 - 91.9 = 2.1 dB



Channel = 212
Frequency = 2.475 GHz
Polarity = Vertical
Modulation / Data Rate = MSK / 500 KBaud
Measurement Distance = 3 meters
System Gain (SG) = Preamp Gain - Cable Loss = 22.2 dB @ 2.433 GHz
Antenna Factor (AF) = 26.5 dB/M @ 2.433 GHz
Field Strength (FS) = Lev(dBuV) + AF(dB/M) - SG(dB)
FS (peak) = 91.2 + 26.5 - 22.2 = 95.5 dBuV/M
FS (Average) = 87.9 + 26.5 - 21.7 = 92.7 dBuV/M

FS Limit (Average) = 50 mV/M @ 3 meters = 94 dBuV/M @ 3 meters
Margin = 94.0 - 92.7 = 1.3 dB

Harmonic Field Strength

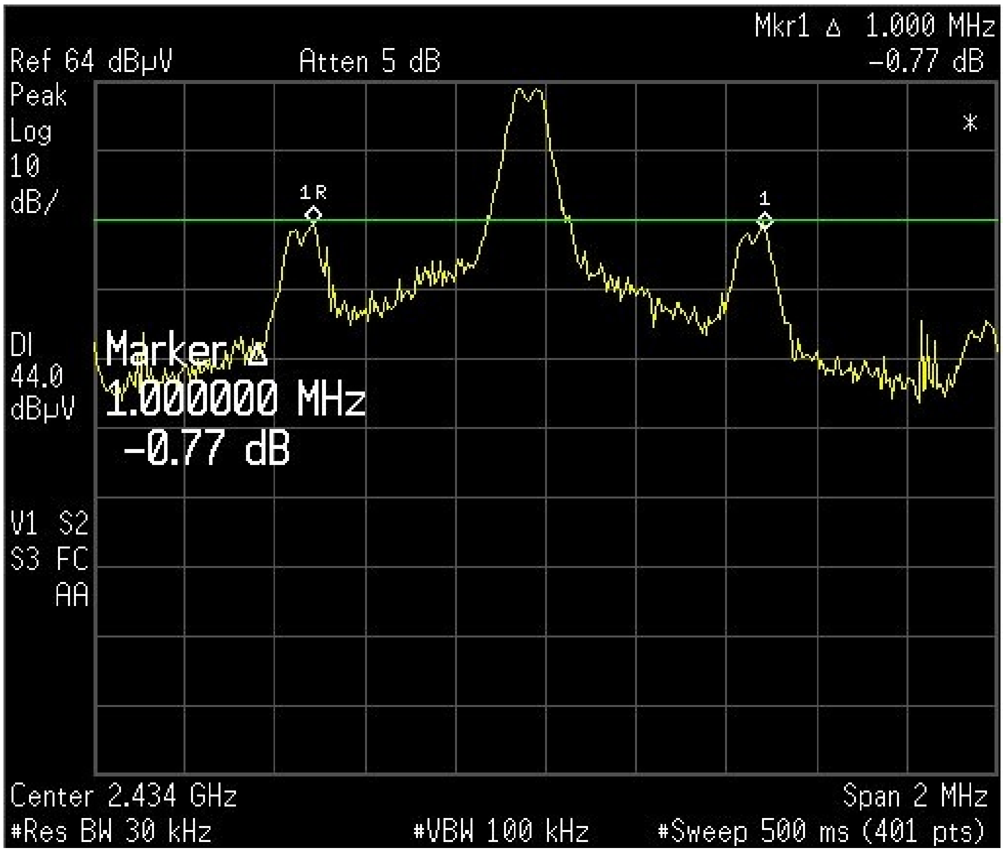
Highest amplitude harmonics for (Channel 3, 103 & 212)
Restricted Bands Limit = 54 dBuV/M @ 3 Meters
Harmonics Limit = 54 dBuV/M @ 3 Meters
SA RBW = 1 MHz / VBW = 3 MHz

Measured @ 3 Meters

Channel	Frequency of Harmonic (GHz)	Spec Limit (dBµV/M) Average Detector	Measurement (dBµV/M) Average Detector	Δ Limit	Polarity	Height (cm)
3	4.867	54.0	50.2	-3.8	Vertical	100
3	7.301	54.0	48.8	-5.2	Vertical	100
103	9.823	54.0	50.8	-3.2	Vertical	100
103	12.266	54.0	45.0	-9.0	Vertical	100
3	14.601	54.0	50.0	-4.0	Vertical	100
212	17.331	54.0	50.0	-4.0	Vertical	100

No other harmonics were observed.

20 dB Bandwidth (99% Occupied Bandwidth)



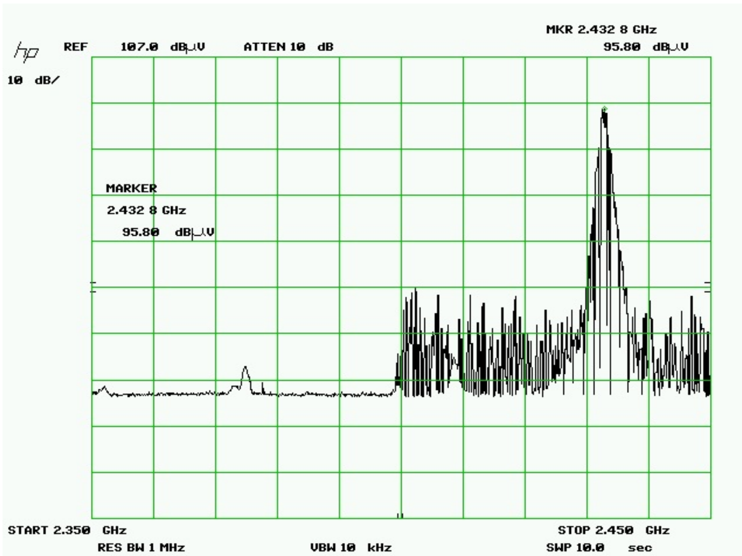
Test data from 30-1000 MHz

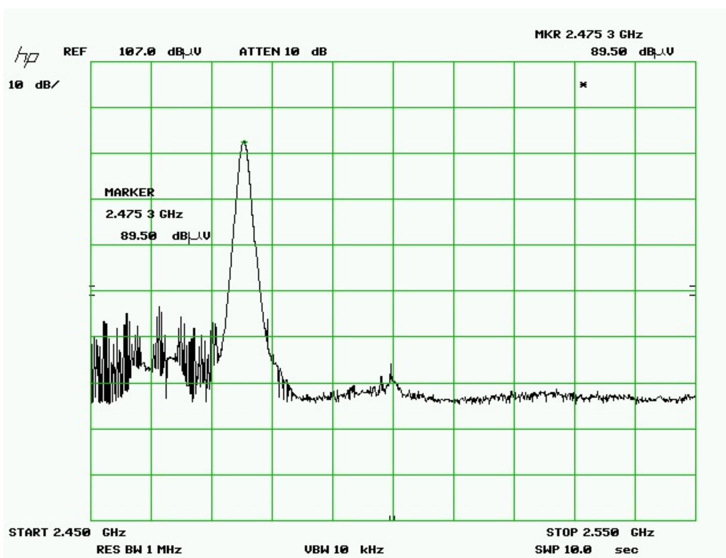
PRODUCT EMISSIONS

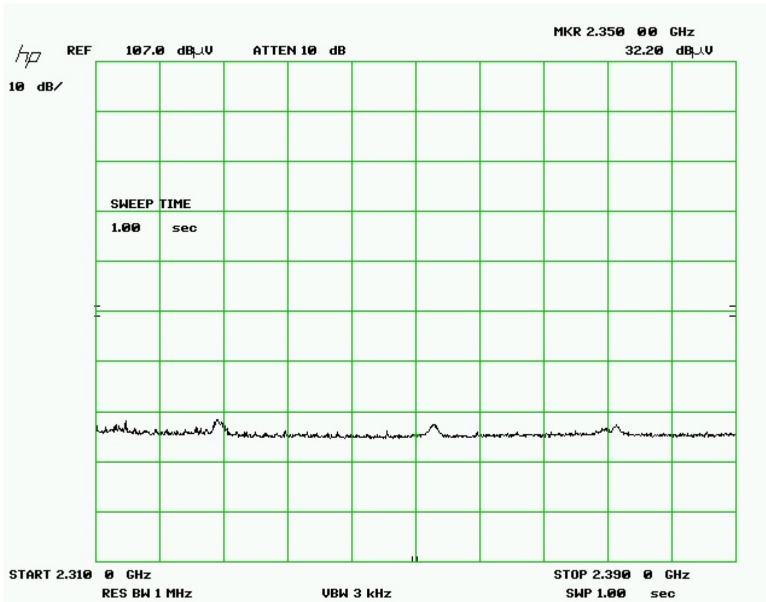
PRODUCT SAFETY ENGINEERING
PRODUCT SAFETY ENGINEERING Data File: CPS 10M CLASSB BELOW 1GHZ 2/9/10

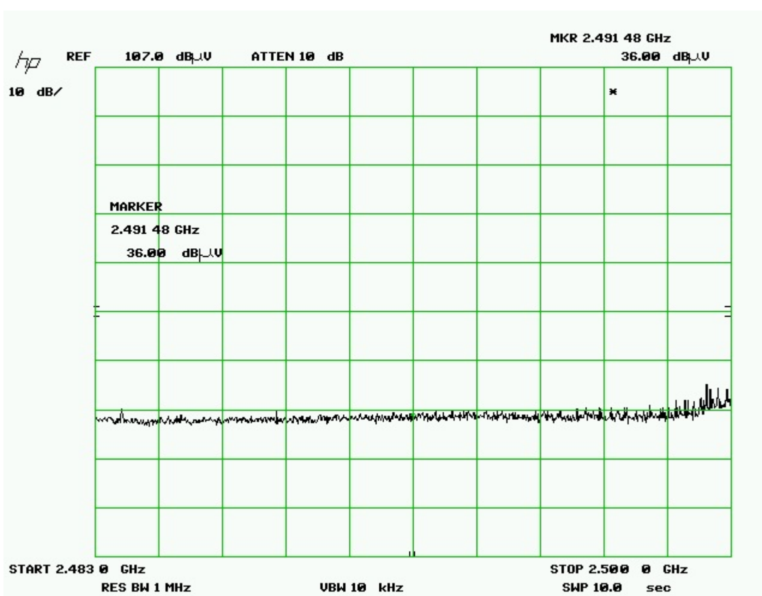
No	EMISSION FREQUENCY MHz	SPEC LIMIT dBuV/m	MEASUREMENTS ABS dBuV/m	dLIM dB	MODE	POL	SITE HGT cm	AZM deg	CORR FACTOR dB	COMMENTS
1	36.011	30.0	24.3	-5.7	PK	V	150	180	-16.7	
2	47.975	30.0	24.5	-5.5	PK	V	200	135	-17.3	
3	66.80	30.0	23.8	-6.2	PK	V	100	90	-18.3	
4	72.760	30.0	27.0	-3.0	QP	V	100	45	-19.4	
5	110.664	30.0	22.3	-7.8	PK	H	300	1	-13.7	
6	133.300	30.0	22.6	-7.4	PK	V	100	180	-13.8	
7	144.130	30.0	23.4	-6.6	PK	V	100	90	-13.	
8	157.06	30.0	24.3	-5.7	PK	V	100	90	-12.3	
9	166.590	30.0	23.4	-6.7	PK	V	100	225	-11.5	
10	208.530	30.0	21.3	-8.7	PK	V	100	225	-14.6	
11	239.971	37.0	28.0	-9.0	PK	H	100	1	-13.9	
12	244.180	37.0	29.3	-7.7	PK	H	100	45	-13.8	
13	255.532	37.0	28.5	-8.5	PK	H	100	45	-13.4	
14	431.998	37.0	28.2	-8.8	PK	V	150	90	-9.5	
15	545.200	37.0	31.7	-5.3	PK	H	200	90	-7.8	
16	550.058	37.0	31.5	-5.6	PK	H	200	135	-7.7	
17	684.009	37.0	27.5	-9.5	PK	H	200	135	-4.3	

Bandedge Compliance






REF 107.0 dBµV
ATTEN 10 dB
MKR 2.350 00 GHz
32.20 dBµV
10 dB/
SWEEP TIME
1.00 sec
START 2.310 0 GHz
STOP 2.390 0 GHz
RES BW 1 MHz
VBW 3 kHz
SWP 1.00 sec


REF 107.0 dBµV
ATTEN 10 dB
MKR 2.491 48 GHz
36.00 dBµV
10 dB/
MARKER
2.491 48 GHz
36.00 dBµV
START 2.483 0 GHz
STOP 2.500 0 GHz
RES BW 1 MHz
VBW 10 kHz
SWP 10.0 sec

CPS Modular Transmitter

15.249(d) Please provide, **TABULAR DATA in dBuV/m showing compliance**, for the band edge plots for 2400 MHz and 2483.5 MHz, as well as the lower restricted band of 2310-2390 MHz.

1) Field Strength of the lower restricted band of 2310-2390 MHz
2) Field Strength of the Band Edge at 2400 MHz
3) Field Strength of the Band Edge at 2483.5 MHz

Limit = 54 dBuV/M @ 3 Meters

SA RBW = 1 MHz

Measured @ 3 Meters

Frequency (MHz)	Spec Limit (dBµV/M) Average Detector	Measurement (dBµV/M) Average Detector	Δ Limit	Polarity	Height (cm)
1) 2310-2390	54.0	39.5	-14.5	Vertical	100
2) 2400.0	54.0	46.5	-7.5	Vertical	100
3) 2483.5	54.0	45.5	-8.5	Vertical	100

Sample Calculation

Level (dBuV/M) = Level (dBuV) + AF (dB/M) - System Gain (dB)
Horn AF = 26.5 dB/M (worst case through measurement range)
System Gain (2300 MHz to 2500 MHz) = 22 dB (worst case through measurement range)
System Gain = combination of +30 dB HP Pre-Amp with cable loss

Example:
At 2400 MHz
Level (dBuV/M) = 42 dBuV + 26.5 dB/M - 22 dB = 46.5 dBuV/M