

## Low duty factor analysis report for SAR test exclusion

The “SAY necklace” device uses the BT classic mode for an Animation Download purposes only. During the download “SAY necklace” receives 60000 bytes per second and transmits two bytes per each batch of 2000 received bytes (60 bytes per second) as acknowledge message, where number N of acknowledge transmissions is :

$$N = 2 \times 60000/2000 = 60 \text{ bytes/s}$$

Transmission time for 1 byte is  $1 \text{ s}/60000 \text{ bytes} = 16.7 \text{ } \mu\text{sec}$ .

Within a 6 min period the total transmission time will be

$$0.0000167 \text{ s} \times 60 \text{ (bytes/s)} \times 360 \text{ sec} = 0.361 \text{ sec}$$

A duty cycle equals to

$$0.361 \text{ s} / 360 \text{ sec} = 0.001 = 0.1 \%$$

The “SAY necklace” gadget transmitter is used as a portable device operating in 2402 – 2480 MHz band. It is equipped with an integral antenna.

Maximum measured transmitter power derived from section 7.7, Table 7.7.2 of the HERRAD FCC.28858 measurement test report:

P <sub>out</sub> conducted		Maximum antenna gain, dBi	P <sub>out</sub> EIRP	
dBm	mW		dBm	mW
13.76	23.8	1.72	15.48	35

The SAR test exclusion threshold for 2.48 GHz at test separation distances 5.0 mm is as follows:

$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \times [\sqrt{f(\text{GHz})}] \leq 3.0$

The max transmitter duty cycle is 0.1%.

The equivalent averaged conducted power is 0.024 mW, the equivalent averaged EIRP is 0.035 mW

$$35 \text{ mW} \times \text{duty cycle} = 35 \text{ mW} \times 0.001 = 0.035 \text{ mW}$$

$$[0.035 \text{ mW}/5.0 \text{ mm}] \times \sqrt{2.48} = 0.007 \times 1.575 = 0.011 \leq 3.0,$$

where 5 mm is the smallest distance from antenna to outer surface of the device.

According to KDB 447498 D01 v06 the device is excluded from SAR evaluation.

## **SAY necklace**

### ***Functional Description***

SAY necklace is a wearable consumer device like a medallion. It allows display animations, previously downloaded wirelessly via a BLUETOOTH 4.0 Smart Ready interface from any suitable smartphone. The downloaded animations are shown cyclically on a 128\*128 pixels color OLED display. SAY necklace is powered from a built-in rechargeable Li-Po battery. It can be charged from any standard 5V DC USB charger via a standard USB-A to micro-USB-B cable. Before operating SAY necklace the first time, a proper application should be downloaded and installed on the user's smartphone.

## **1. Functional Description**

The Block Diagram of SAY necklace on page 3 includes the following:

- a. Li-Po BATTERY (3.7V 700 mAh);
- b. CHARGING & POWER SUPPLY CIRCUIT;
- c. Micro USB-B CHARGING CONNECTOR;
- d. ESD PROTECTION circuit;
- e. OLED display (128\*128 pixels, 262k possible colors);
- f. Serial FLASH MEMORY;
- g. 3-axis ACCELEROMETER;
- h. BLUETOOTH SMART READY TRANSCEIVER;
- i. BLUETOOTH CHIP ANTENNA;
- j. ANTENNA MATCHING CIRCUIT;
- k. RESET BUTTON;
- l. 32.768 KHz crystal;
- m. 26.000 MHz crystal;

## **2. SAY necklace Operating Description**

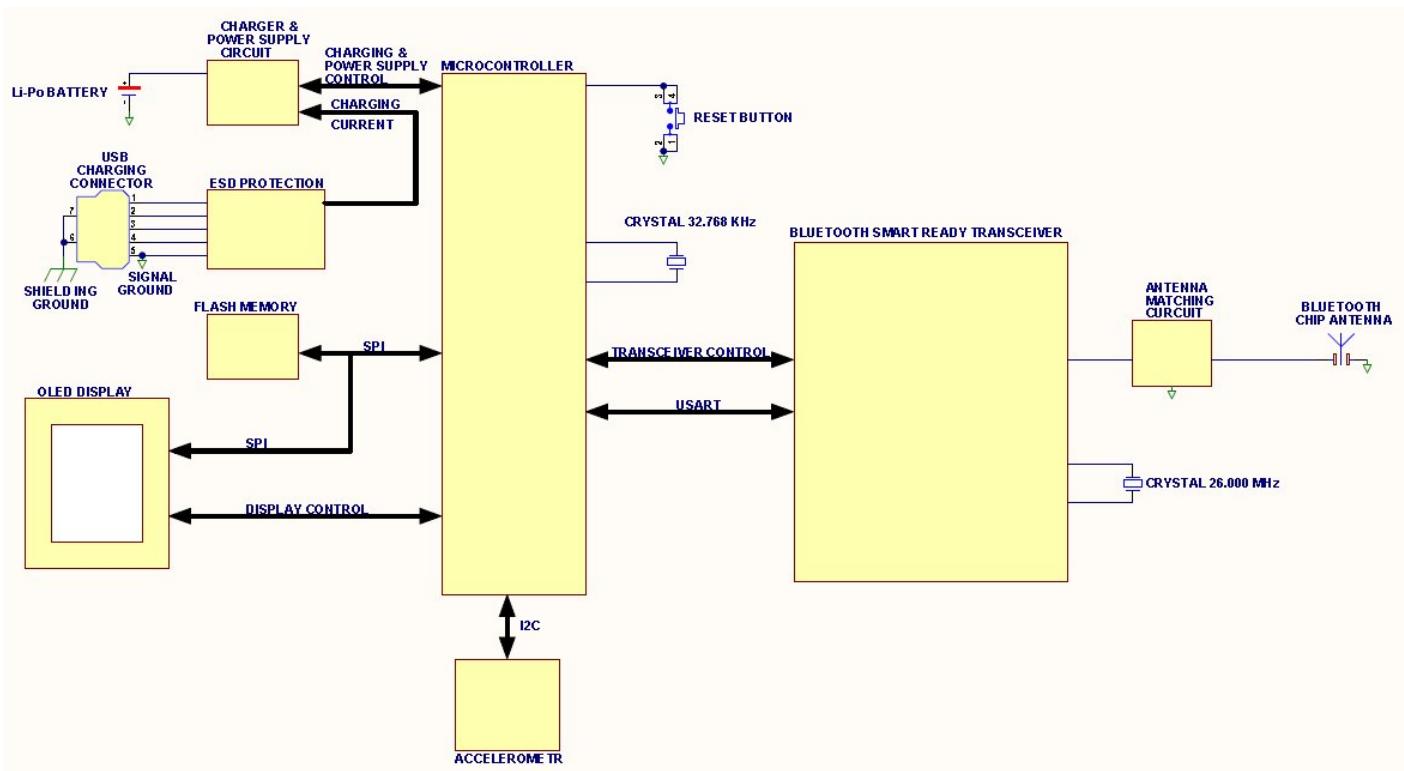
SAY necklace is delivered with battery turned off (disconnected). To turn the battery on SAY necklace should be connected to any standard USB host computer, hub or charger using the delivered **USB-A to Micro-USB-B** cable. Being connected to a proper power source, the Constant Voltage/Constant Current CHARGING CIRCUIT turns on the internal power source. After initialization SAY necklace will display the “Battery Charging” icon and then it will start some default animation. The battery comprises a built-in an Overcurrent/Overvoltage/Undervoltage circuit. That circuit disconnects the battery in case of any abnormal condition.

In normal condition microcontroller manages a continuous animation reading it frame by frame from the FLASH MEMORY and sending it to the OLED DISPLAY.

The ACCELEROMETER continuously monitors mobility of SAY necklace: if it is motionless for some time period, than microcontroller puts it into a Sleep mode. Then any motion resumes the active mode.

The BLUETOOTH TRANSCEIVER periodically applies to the coupled smartphone. If user initiates a New Animation Download process, the new animation file is transmitted via the BLUETOOTH TRANSCEIVER to the MICROCONTROLLER and stored in the FLASH MEMORY. After completing download the new animation replaces the previous one on the OLED DISPLAY.

In case the download process was interrupted for some reason and it cannot be resumed any more, the RESET BUTTON being pressed restarts the “hung” device.



SAY necklace V3.3 **Block Diagram**

**BLUETOOTH SMART READY RF PERFORMANCE****1. Bluetooth BR/EDR RF Performance**

All parameters in this section that are fast-clock dependent are verified using a 26-MHz XTAL under a temperature range from  $-20^{\circ}\text{C}$  to  $70^{\circ}\text{C}$  and an RF load of  $50\ \Omega$  at the BT\_RF port.

**a. Bluetooth Receiver—In-Band Signals**

CHARACTERISTICS	CONDITION	MIN	TYP	MAX	BLUETOOTH SPECIFICATION	UNIT
Operation frequency range		2402		2480		MHz
Channel spacing			1			MHz
Input impedance			50			$\Omega$
Sensitivity, dirty TX on <sup>(1)</sup>	GFSK, BER = 0.1%	-91.5	-95	-70		dBm
	Pi4-DQPSK, BER = 0.01%	-90.5	-94.5	-70		
	8DPSK, BER = 0.01%	-81	-87.5	-70		
BER error floor at sensitivity + 10dB, dirty TX off	Pi4-DQPSK	1E-6	1E-7	1E-5		
	8DPSK	1E-6		1E-5		
Maximum usable input power	GFSK, BER = 0.1%	-5		-20		dBm
	Pi4-DQPSK, BER = 0.1%	-10				
	8DPSK, BER = 0.1%	-10				
Intermodulation characteristics	Level of interferers (for n = 3, 4, and 5)	-36	-30	-39		dBm
C/I performance <sup>(2)</sup> Image = $-1\ \text{MHz}$	GFSK, co-channel	8	10	11		dB
	EDR, co-channel	Pi4-DQPSK	9.5	11	13	
		8DPSK	16.5	20	21	
	GFSK, adjacent $\pm 1\ \text{MHz}$		-10	-5	0	
	EDR, adjacent $\pm 1\ \text{MHz}$ , (image)	Pi4-DQPSK	-10	-5	0	
		8DPSK	-5	-1	5	
	GFSK, adjacent $\pm 2\ \text{MHz}$		-38	-35	-30	
	EDR, adjacent $\pm 2\ \text{MHz}$	Pi4-DQPSK	-38	-35	-30	
		8DPSK	-38	-30	-25	
	GFSK, adjacent $\pm 2\ \text{MHz}$		-28	-20	-20	
	EDR, adjacent $\pm 2\ \text{MHz}$	Pi4-DQPSK	-28	-20	-20	
		8DPSK	-22	-13	-13	
	GFSK, adjacent $\pm 3\ \text{MHz}$		-45	-43	-40	
	EDR, adjacent $\pm 3\ \text{MHz}$	Pi4-DQPSK	-45	-43	-40	
		8DPSK	-44	-36	-33	
RF return loss		-10				dB
RX mode LO leakage	Fr <sub>f</sub> = (received RF - 0.6 MHz)	-63	-58			dBm

(1) Sensitivity degradation up to 3 dB may occur for minimum and typical values where the Bluetooth frequency is a harmonic of the fast clock.

(2) Numbers show ratio of desired signal to interfering signal. Smaller numbers indicate better C/I performance.

**b. Bluetooth Receiver—General Blocking**

CHARACTERISTICS	CONDITION	MIN	TYP	UNIT
Blocking performance over full range, according to Bluetooth specification <sup>(1)</sup>	30 to 2000 MHz		-6	dBm
	2000 to 2399 MHz		-6	
	2484 to 3000 MHz		-6	
	3 to 12.75 GHz		-6	

(1) Exceptions are taken out of the total 24 allowed in the Bluetooth specification.

**c. Bluetooth Transmitter—GFSK**

CHARACTERISTICS	MIN	TYP	MAX	BLUETOOTH SPECIFICATION	UNIT
Maximum RF output power <sup>(1)</sup>	10	12			dBm
Power variation over Bluetooth band	-1		1		dB
Gain control range		30		2 to 8	dB
Power control step	2	5	8		
Adjacent channel power  M–N  = 2		-45	-39	≤ -20	dBm
Adjacent channel power  M–N  > 2		-50	-42	≤ -40	

(1) To modify maximum output power, use an HCI VS command.

**d. Bluetooth Transmitter—EDR**

CHARACTERISTICS	MIN	TYP	MAX	BLUETOOTH SPECIFICATION	UNIT
Maximum RF output power <sup>(1)</sup>	6	8		dBm	
	8	8			
Relative power	-2		1	-4 to +1	dB
Power variation over Bluetooth band	-1		1		dB
Gain control range		30			dB
Power control step	2	5	8	2 to 8	dB
Adjacent channel power  M–N  = 1		-36	-30	≤ -26	dBc
Adjacent channel power  M–N  = 2 <sup>(2)</sup>		-30	-23	≤ -20	dBm
Adjacent channel power  M–N  > 2 <sup>(2)</sup>		-42	-40	≤ -40	dBm

(1) To modify maximum output power, use an HCI VS command.

(2) Assumes 3-dB insertion loss from Bluetooth RF ball to antenna

**e. Bluetooth Modulation—GFSK**

CHARACTERISTICS	CONDITION	SYM	MIN	TYP	MAX	BLUETOOTH SPECIFICATION	UNIT
-20 dB bandwidth	GFSK			925	995	≤ 1000	kHz
Modulation characteristics	Δf1avg	Mod data = 4 1 s, 4 0 s, 111100001111...	F1 avg	150	165	170	140 to 175
	Δf2max ≥ limit for at least 99.9% of all Δf2max	Mod data = 1010101...	F2 max	115	130		> 115
	Δf2avg, Δf1avg			85%	88%		> 80%
Absolute carrier frequency drift	DH1		-25		25	< ±25	kHz
	DH3 and DH5		-35		35	< ±40	
Drift rate					15	< 20	kHz/50 μs
Initial carrier frequency tolerance	f0 – fTX		-75		+75	< ±75	kHz

**f. Bluetooth Modulation—EDR**

CHARACTERISTICS	CONDITION	MIN	TYP	MAX	BLUETOOTH SPECIFICATION	UNIT
Carrier frequency stability				±5	≤ 10	kHz
Initial carrier frequency tolerance				±75	±75	kHz
RMS DEVM <sup>(1)</sup>	Pi/4-DQPSK		6%	15%	20%	
	8DPSK		6%	13%	13%	
99% DEVM <sup>(1)</sup>	Pi/4-DQPSK			30%	30%	
	8DPSK			20%	20%	
Peak DEVM <sup>(1)</sup>	Pi/4-DQPSK		14%	30%	35%	
	8DPSK		16%	25%	25%	

(1) Max performance refers to maximum TX power.

**g. Bluetooth Transmitter—Out-of-Band and Spurious Emissions**

CHARACTERISTICS	CONDITION	TYP	MAX	UNIT
Second harmonic <sup>(1)</sup>	Measured at maximum output power	−14	−2	dBm
Third harmonic <sup>(1)</sup>		−10	−6	dBm
Fourth harmonics <sup>(1)</sup>		−19	−11	dBm

(1) Meets FCC and ETSI requirements with external filter shown in Figure 7-1

**2. Bluetooth LE RF Performance**

All parameters in this section that are fast-clock dependent are verified using a 26-MHz XTAL under a temperature range from  $-20^{\circ}\text{C}$  to  $70^{\circ}\text{C}$  and an RF load of  $50\ \Omega$  at the BT\_RF port.

**a. BLE Receiver—In-Band Signals**

CHARACTERISTIC	CONDITION	MIN	TYP	MAX	BLE SPECIFICATION	UNIT
Operation frequency range		2402		2480		MHz
Channel spacing			2			MHz
Input impedance			50			$\Omega$
Sensitivity, dirty TX on <sup>(1)</sup>	PER = 30.8%; dirty TX on	-93	-96		$\leq -70$	dBm
Maximum usable input power	GMSK, PER = 30.8%	-5			$\geq -10$	dBm
Intermodulation characteristics	Level of interferers (for n = 3, 4, 5)	-36	-30		$\geq -50$	dBm
C/I performance <sup>(2)</sup> Image = -1 MHz	GMSK, co-channel		8	12	$\leq 21$	dB
	GMSK, adjacent $\pm 1$ MHz		-5	0	$\leq 15$	
	GMSK, adjacent +2 MHz		-45	-38	$\leq -17$	
	GMSK, adjacent -2 MHz		-22	-15	$\leq -15$	
	GMSK, adjacent $\geq  \pm 3 $ MHz		-47	-40	$\leq -27$	
RX mode LO leakage	Fr <sub>f</sub> = (received RF - 0.6 MHz)	-63	-58			dBm

(1) Sensitivity degradation up to 3 dB may occur where the BLE frequency is a harmonic of the fast clock.

(2) Numbers show wanted signal-to-interfering signal ratio. Smaller numbers indicate better C/I performance.

### b. BLE Receiver—General Blocking

CHARACTERISTICS	CONDITION	MIN	TYP	BLE SPECIFICATION	UNIT
Blocking performance over full range, according to BLE specification <sup>(1)</sup>	30 to 2000 MHz		-15	$\geq -30$	dBm
	2000 to 2399 MHz		-15	$\geq -35$	
	2484 to 3000 MHz		-15	$\geq -35$	
	3 to 12.75 GHz		-15	$\geq -30$	

(1) Exceptions are taken out of the total 10 allowed in the BLE specification.

### c. BLE Transmitter

CHARACTERISTICS	MIN	TYP	MAX	BLE SPECIFICATION	UNIT
Maximum RF output power <sup>(1)</sup>	10	12 <sup>(2)</sup>		$\leq 10$	dBm
Power variation over BLE band	-1		1		dB
Adjacent channel power $ M-N  = 2$		-45	-39	$\leq -20$	dBm
Adjacent channel power $ M-N  > 2$		-50	-42	$\leq -30$	

(1) To modify maximum output power, use an HCI VS command.

(2) To achieve the BLE specification of 10-dBm maximum, an insertion loss of > 2 dB is assumed between the RF ball and the antenna. Otherwise, use an HCI VS command to modify the output power.

### d. BLE Modulation

CHARACTERISTICS	CONDITION		SYM	MIN	TYP	MAX	BLE SPEC.	UNIT
Modulation characteristics	Δf1avg	Mod data = 4 1s, 4 0 s: 1111000011110000...	Δf1 avg	240	250	260	225 to 275	kHz
	Δf2max ≥ limit for at least 99.9% of all Δf2max	Mod data = 1010101...	Δf2 max	185	210		≥ 185	kHz
	Δf2avg, Δf1avg			0.85	0.9		≥ 0.8	
Absolute carrier frequency drift				-25		25	≤ ±50	kHz
Drift rate						15	≤ 20	kHz/50 ms
Initial carrier frequency tolerance				-75		75	≤ ±100	kHz

# TEST REPORT

ACCORDING TO: FCC 47CFR part 15 subpart C § 15.247 (FHSS) and subpart B

FOR:

**Hermes Innovation Ltd.**  
**Smartphone controlled wearable**  
**gadget with OLED display**  
**Model: SAY necklace**  
**FCC ID:2AKDU100**

This report is in conformity with ISO/ IEC 17025. The "A2LA Accredited" symbol endorsement applies only to the tests and calibrations that are listed in the scope of Hermon Laboratories accreditation. The test results relate only to the items tested.  
This test report shall not be reproduced in any form except in full with the written approval of Hermon Laboratories Ltd.



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## 1 Applicant information

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**Telephone:** +972-72-274-8730  
**Fax:** +972-3-958-5525  
**E-mail:** leveitan@gmail.com  
**Contact name:** Mr. Eitan Lev

## 2 Equipment under test attributes

**Product name:** Smartphone controlled wearable gadget with OLED display  
**Product type:** Transceiver  
**Model(s):** SAY necklace  
**Serial number:** Prototype  
**Hardware version:** 3.3  
**Software release:** 1.0  
**Receipt date** 29-Sep-16

## 3 Manufacturer information

**Manufacturer name:** Hermes Innovation Ltd.  
**Address:** 12 Ayelet Hashahar St., Even Yehuda 4053085, Israel  
**Telephone:** +972-72-274-8730  
**Fax:** +972-3-958-5525  
**E-Mail:** leveitan@gmail.com  
**Contact name:** Mr. Eitan Lev

## 4 Test details

**Project ID:** 28858  
**Location:** Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel  
**Test started:** 29-Sep-16  
**Test completed:** 25-Oct-16  
**Test specification(s):** FCC 47CFR part 15 subpart C § 15.247 (FHSS) and subpart B, class B



## 5 Tests summary

Test	Status
<b>Transmitter characteristics</b>	
Section 15.247(a)1, 20 dB bandwidth	Pass
Section 15.247(a)1, Frequency separation	Pass
Section 15.247(a)1, Number of hopping frequencies	Pass
Section 15.247(a)1, Average time of occupancy	Pass
Section 15.247(b), Peak output power	Pass
Section 15.247(d), Radiated spurious emissions	Pass
Section 15.247(d), Emissions at band edges	Pass
Section 15.247(i)5, RF exposure	Pass, the exhibit to the application of certification is provided
Section 15.203, Antenna requirements	Pass
Section 15.207(a), Conducted emission	Pass
<b>Unintentional emissions</b>	
Section 15.107, Conducted emission at AC power port	Pass
Section 15.109, Radiated emission	Pass

Testing was completed against all relevant requirements of the test standard. The results obtained indicate that the product under test complies in full with the requirements tested.

The test results relate only to the items tested. Pass/ fail decision was based on nominal values.

	Name and Title	Date	Signature
<b>Tested by:</b>	Mrs. E. Pitt, test engineer	October 25, 2016	
<b>Reviewed by:</b>	Mrs. M. Cherniavsky, certification engineer	November 16, 2016	
<b>Approved by:</b>	Mr. M. Nikishin, EMC and radio group leader	December 18, 2016	

## 6 EUT description

### 6.1 General information

The EUT is a wearable device, comprising OLED display, rechargeable Li-Po battery (600 mAh) and a Smart Ready Class 2 Bluetooth interface. The EUT comprises a non approved BLE/BT module operating in 2402-2480 MHz frequency range. The EUT is powered from external AC/DC adapter connected via the MICRO-USB-B connector and is defined for indoor use only. The AC/DC adapter manufactured by GPT, model PCU-240 was used throughout the testing. The EUT was tested in "Operation during Charging" mode.

### 6.2 Ports and lines

Port type	Port description	Connected from	Connected to	Qty.	Cable type	Cable length	Indoor / outdoor
Power	MICRO-USB-B	EUT	AC/DC adapter	1	Shielded	0.9 m	Indoor
Power	AC power	AC/DC adapter	AC mains	1	NA	NA	Indoor

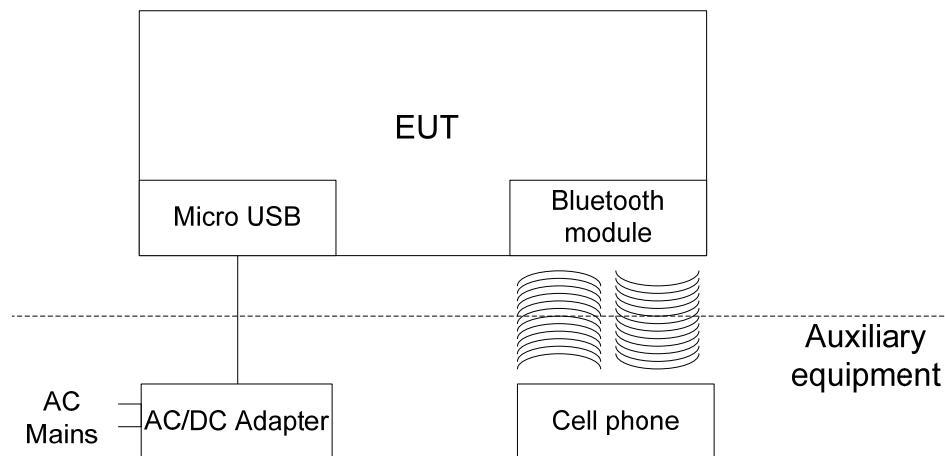
### 6.3 Auxiliary equipment

Description	Manufacturer	Model number	Serial number
Cellular phone	LG	LG-D821	353490-06-004345-8

### 6.4 Changes made in EUT

No changes were implemented in the EUT during the testing.

### 6.5 Test configuration





## 6.6 EUT test positions

Photograph 6.6.1 EUT in X-axis orthogonal position



Photograph 6.6.2 EUT in Y-axis orthogonal position



Photograph 6.6.3 EUT in Z-axis orthogonal position





## 6.7 Transmitter characteristics

Type of equipment									
Stand-alone (Equipment with or without its own control provisions)									
X Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)									
Plug-in card (Equipment intended for a variety of host systems)									
Intended use	Condition of use								
fixed	Always at a distance more than 2 m from all people								
mobile	Always at a distance more than 20 cm from all people								
X portable	May operate at a distance closer than 20 cm to human body								
Assigned frequency range	2400-2483.5 MHz								
Operating frequency range	2402 – 2480 MHz								
Maximum rated output power	At transmitter 50 Ω RF output connector				NA				
	Peak output power				12.76 dBm @ BLE modulation 13.76 dBm @ GFSK modulation 13.23 dBm @ 8DPSK modulation 13.71 dBm @ DQPSK modulation				
Is transmitter output power variable?	X	No							
	Yes	continuous variable							
			stepped variable with stepsize		dB				
			minimum RF power		dBm				
			maximum RF power		dBm				
Antenna connection									
unique coupling	standard connector		X integral	with temporary RF connector					
			X	without temporary RF connector					
Antenna/s technical characteristics									
Type	Manufacturer		Model number		Gain				
Embedded 2.4 GHz antenna	Ethertronics		P/N 1001312		1.72 dBi				
Transmitter aggregate data rate/s									
Type of modulation									
BLE(GFSK)	GFSK		8DPSK	DQPSK					
0.25 Mbps	0.925 Mbps		3 Mbps	3 Mbps					
Modulating test signal (baseband)									
Transmitter power source									
X Battery	Nominal rated voltage		3.7 V	Battery type	Lithium-Polymer				
DC	Nominal rated voltage		VDC						
X AC mains	Nominal rated voltage		120 VAC	Frequency	60 Hz				
Spread spectrum parameters for transmitters tested per FCC 15.247 only									
FHSS	Total number of hops		79						
	Bandwidth per hop		1378 kHz						
	Max. separation of hops		1015 kHz						



HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b), Peak output power			
<b>Test procedure:</b> ANSI C63.10, section 7.8.5			
<b>Test mode:</b> Compliance			<b>Verdict:</b> PASS
<b>Date(s):</b> 29-Sep-16 - 05-Oct-16			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1005 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b> 8DPSK modulation			

## 7.5 Peak output power at 8DPSK modulation

### 7.5.1 General

This test was performed to measure the maximum peak output power radiated by transmitter. Specification test limits are given in Table 7.5.1.

Table 7.5.1 Peak output power limits

Assigned frequency range, MHz	Peak output power*		Equivalent field strength limit @ 3m, dB(µV/m)*	Maximum antenna gain, dBi
	W	dBm		
902.0 – 928.0	0.25 (<50 hopping channels)	24.0(<50 hopping channels)	125.2 (<50 hopping channels)	6.0*
	1.0 (≥50 hopping channels)	30.0 (≥50 hopping channels)	131.2 (≥50 hopping channels)	
2400.0 – 2483.5	0.125 (<75 hopping channels)	21.0(<75 hopping channels)	122.2 (<75 hopping channels)	6.0*
	1.0 (≥75 hopping channels)	30.0 (≥75 hopping channels)	131.2 (≥75 hopping channels)	
5725.0 – 5850.0	1.0	30.0	131.2	

\*- Equivalent field strength limit was calculated from the peak output power as follows:  $E = \sqrt{30 \times P \times G} / r$ , where P is peak output power in Watts, r is antenna to EUT distance in meters and G is transmitter antenna gain in dBi.

\*\*- The limit is provided in terms of conducted RF power at the antenna connector. If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power limit shall be reduced below the stated value as follows:

- by 1 dB for every 3 dB that the directional gain of antenna exceeds 6 dBi for fixed point-to-point transmitters operate in 2400-2483.5 MHz band;
- without any corresponding reduction for fixed point-to-point transmitters operate in 5725-5850 MHz band;
- by the amount in dB that the directional gain of antenna exceeds 6 dBi for the rest of transmitters.

### 7.5.2 Test procedure

- 7.5.2.1 The EUT was set up as shown in Figure 7.5.1, energized and its proper operation was checked.
- 7.5.2.2 The EUT was adjusted to produce maximum available to end user RF output power.
- 7.5.2.3 The frequency span of spectrum analyzer was set approximately 5 times wider than 20 dB bandwidth of the EUT and the resolution bandwidth was set wider than 20 dB bandwidth of the EUT. To find maximum radiation the turntable was rotated 360° and the measuring antenna height was swept in both vertical and horizontal polarizations.
- 7.5.2.4 The maximum field strength of the EUT carrier frequency was measured as provided in Table 7.5.2 and associated plots.
- 7.5.2.5 The maximum peak output power was calculated from the field strength of carrier as follows:

$$P = (E \times d)^2 / (30 \times G),$$

where P is the peak output power in W, E is the field strength in V/m, d is the test distance and G is the transmitter numeric antenna gain over an isotropic radiator.

The above equation was converted in logarithmic units for 3 m test distance:

$$\text{Peak output power in dBm} = \text{Field strength in dB}(\mu\text{V}/\text{m}) - \text{Transmitter antenna gain in dBi} - 95.2 \text{ dB}$$

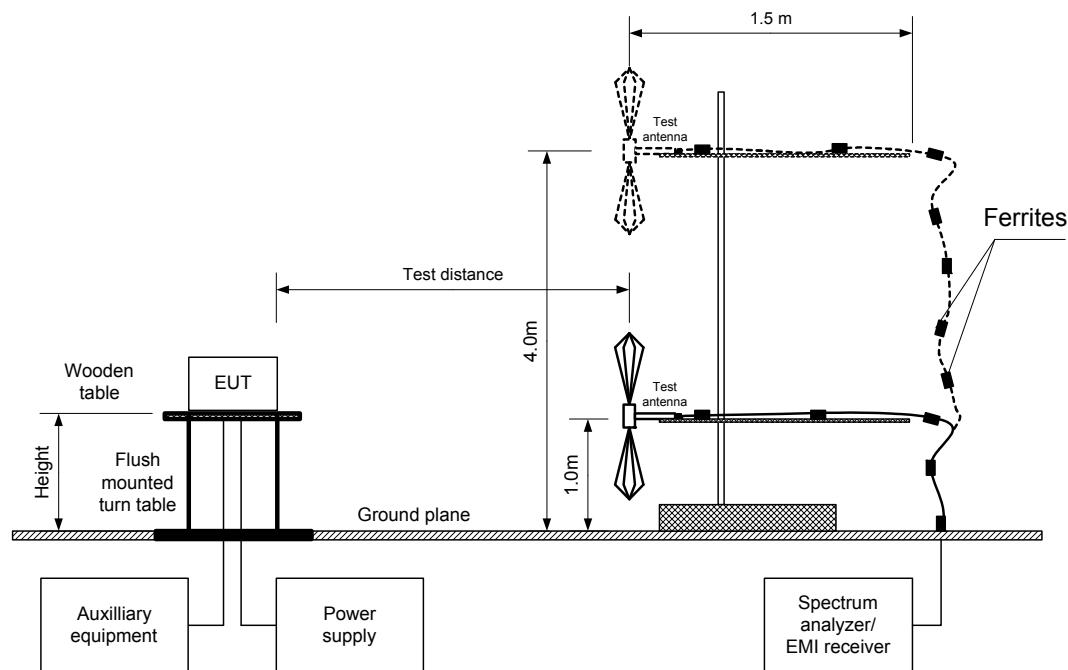
- 7.5.2.6 The worst test results (the lowest margins) were recorded in Table 7.5.2.



HERMON LABORATORIES

<b>Test specification: Section 15.247(b), Peak output power</b>		
<b>Test procedure:</b> ANSI C63.10, section 7.8.5		
<b>Test mode:</b> Compliance	<b>Verdict:</b> <b>PASS</b>	
<b>Date(s):</b> 29-Sep-16 - 05-Oct-16		
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1005 hPa
<b>Remarks:</b> 8DPSK modulation		<b>Power:</b> 120 VAC

Figure 7.5.1 Setup for carrier field strength measurements





HERMON LABORATORIES

Test specification: <b>Section 15.247(b), Peak output power</b>		
Test procedure:	ANSI C63.10, section 7.8.5	
Test mode:	Compliance	Verdict: <b>PASS</b>
Date(s):	29-Sep-16 - 05-Oct-16	
Temperature: 24 °C	Relative Humidity: 44 %	Air Pressure: 1005 hPa
Remarks: 8DPSK modulation		Power: 120 VAC

**Table 7.5.2 Peak output power test results**

ASSIGNED FREQUENCY:	2400-2483.5 MHz
TEST DISTANCE:	3 m
TEST SITE:	Semi anechoic chamber
EUT HEIGHT:	1.5 m
DETECTOR USED:	Peak
TEST ANTENNA TYPE:	Biconilog (30 MHz – 1000 MHz) Double ridged guide (above 1000 MHz)
MODULATION:	8DPSK
MODULATING SIGNAL:	PRBS
BIT RATE:	3 Mbps
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
DETECTOR USED:	Peak
EUT 20 dB BANDWIDTH:	1.371 MHz
RESOLUTION BANDWIDTH:	3 MHz
VIDEO BANDWIDTH:	3 MHz
FREQUENCY HOPPING:	Disabled
NUMBER OF FREQUENCY HOPPING CHANNELS:	

Frequency, MHz	Field strength, dB(µV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	EUT antenna gain, dBi	Peak output power, dBm**	Limit, dBm	Margin, dB***	Verdict
2402	110.15	Horizontal	1.7	10	1.72	13.23	30	-16.77	Pass
2441	107.68	Horizontal	1.7	10	1.72	10.76	30	-19.24	Pass
2480	106.76	Horizontal	1.8	20	1.72	9.84	30	-20.16	Pass

\*- EUT front panel refer to 0 degrees position of turntable.

\*\*- Peak output power was calculated from the field strength of carrier as follows:  $P = (E \times d)^2 / (30 \times G)$ , where P is the peak output power in W, E is the field strength in V/m, d is the test distance in meters and G is the transmitter numeric antenna gain over an isotropic radiator. The above equation was converted in logarithmic units for 3 m test distance: *Peak output power in dBm = Field strength in dB(µV/m) - Transmitter antenna gain in dBi - 95.2 dB*

\*\*\*- Margin = Peak output power – specification limit.

**Reference numbers of test equipment used**

HL 0521	HL 1984	HL 4353	HL 5101				
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Full description is given in Appendix A.

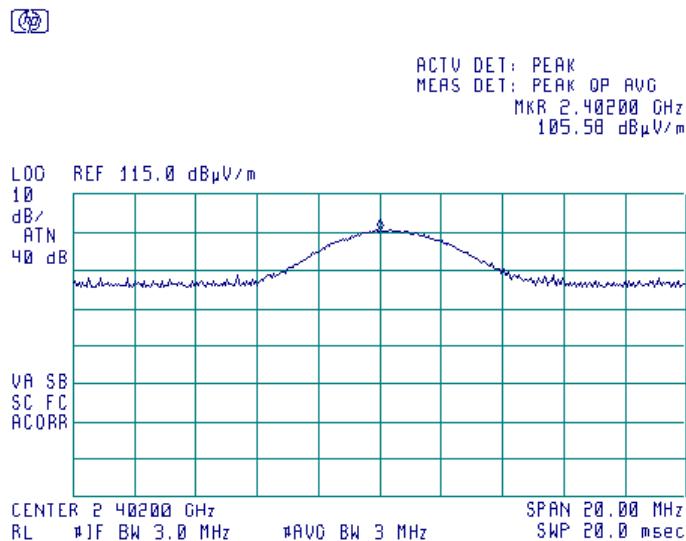


HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b), Peak output power		
<b>Test procedure:</b> ANSI C63.10, section 7.8.5		
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS	
<b>Date(s):</b> 29-Sep-16 - 05-Oct-16		
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1005 hPa
<b>Remarks:</b> 8DPSK modulation		

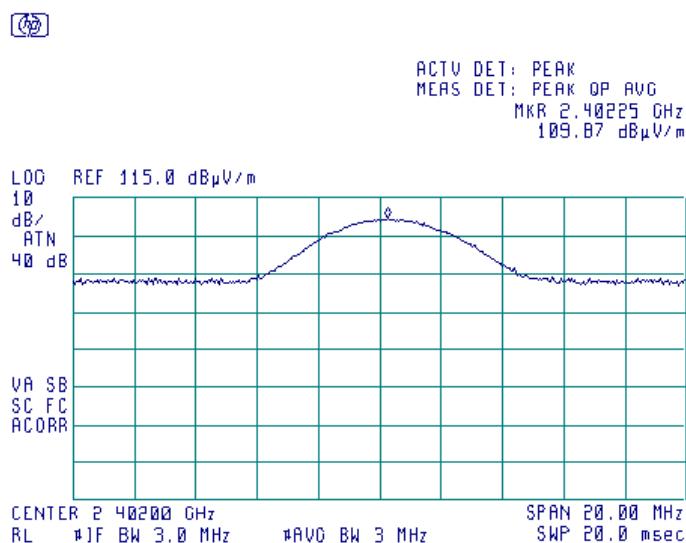
**Plot 7.5.1 Field strength of carrier at low frequency, vertical antenna polarization**

EUT POSITION: X-axis



**Plot 7.5.2 Field strength of carrier at low frequency, vertical antenna polarization**

EUT POSITION: Y-axis



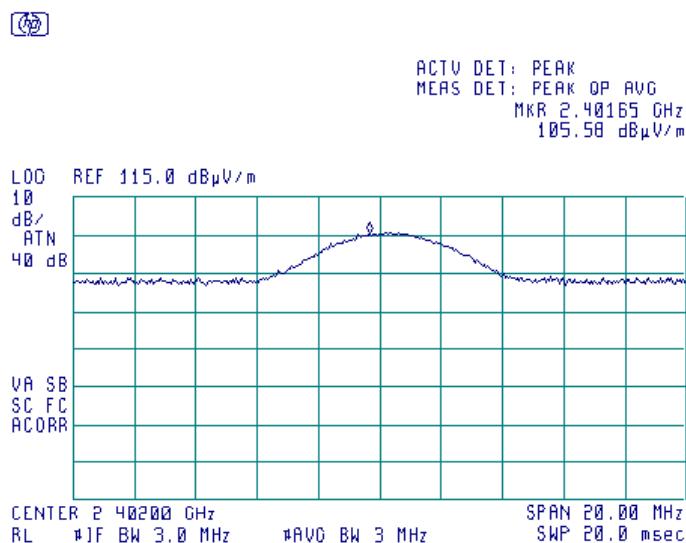


HERMON LABORATORIES

<b>Test specification: Section 15.247(b), Peak output power</b>			
<b>Test procedure:</b> ANSI C63.10, section 7.8.5			
<b>Test mode:</b> Compliance		<b>Verdict:</b> <b>PASS</b>	
<b>Date(s):</b>	29-Sep-16 - 05-Oct-16		
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1005 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b> 8DPSK modulation			

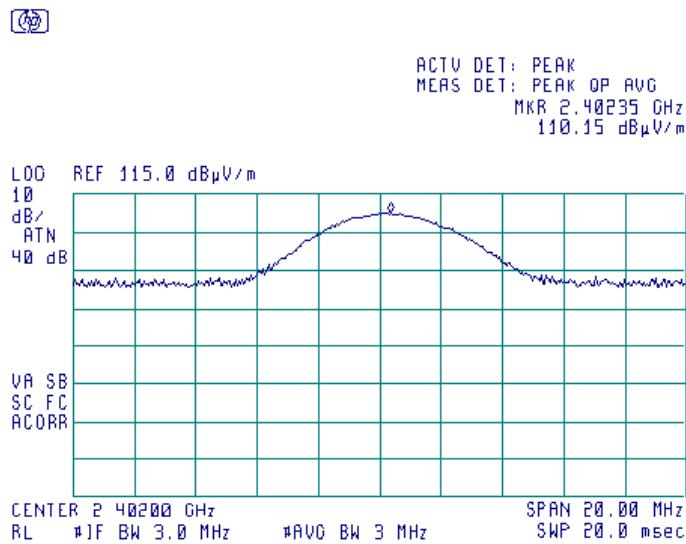
**Plot 7.5.3 Field strength of carrier at low frequency, vertical antenna polarization**

EUT POSITION: Z-axis



**Plot 7.5.4 Field strength of carrier at low frequency horizontal antenna polarization**

EUT POSITION: X-axis



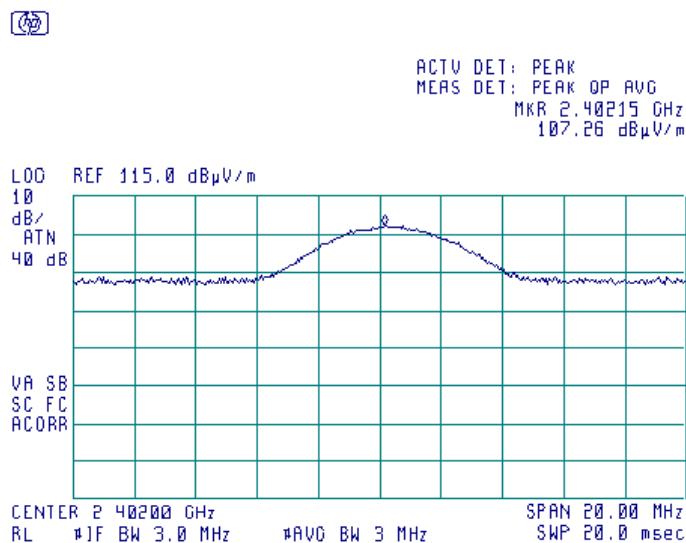


HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b), Peak output power		
<b>Test procedure:</b> ANSI C63.10, section 7.8.5		
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS	
<b>Date(s):</b> 29-Sep-16 - 05-Oct-16		
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1005 hPa
<b>Remarks:</b> 8DPSK modulation		

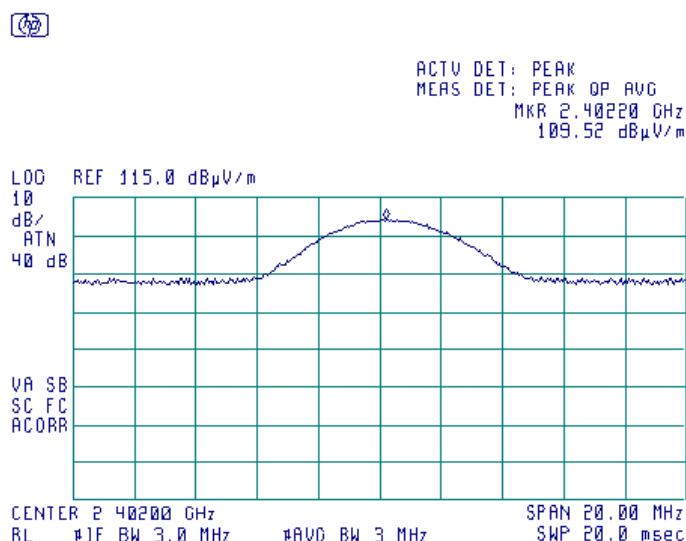
**Plot 7.5.5 Field strength of carrier at low frequency horizontal antenna polarization**

EUT POSITION: Y-axis



**Plot 7.5.6 Field strength of carrier at low frequency horizontal antenna polarization**

EUT POSITION: Z-axis



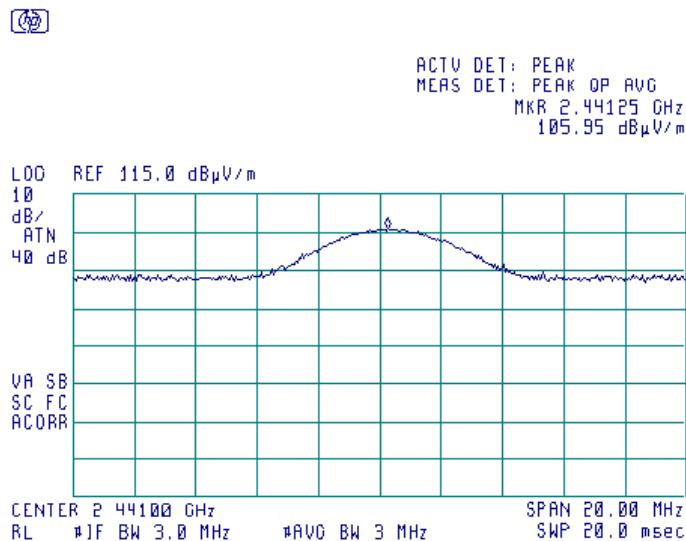


HERMON LABORATORIES

<b>Test specification: Section 15.247(b), Peak output power</b>			
<b>Test procedure:</b> ANSI C63.10, section 7.8.5			
<b>Test mode:</b> Compliance			<b>Verdict:</b> PASS
<b>Date(s):</b> 29-Sep-16 - 05-Oct-16			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1005 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b> 8DPSK modulation			

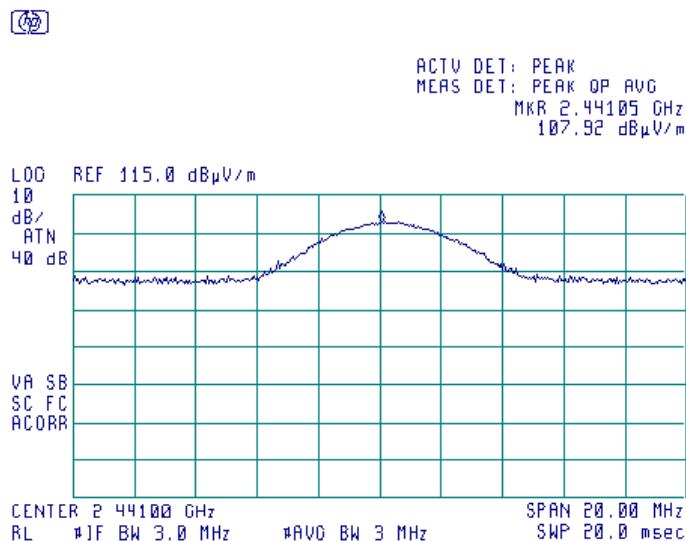
**Plot 7.5.7 Field strength of carrier at mid frequency vertical antenna polarization**

EUT POSITION: X-axis



**Plot 7.5.8 Field strength of carrier at mid frequency vertical antenna polarization**

EUT POSITION: Y-axis



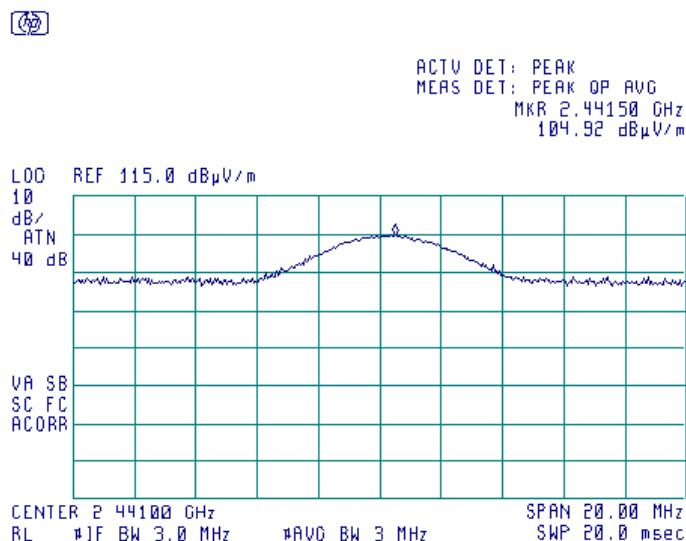


HERMON LABORATORIES

<b>Test specification: Section 15.247(b), Peak output power</b>		
<b>Test procedure:</b> ANSI C63.10, section 7.8.5		
<b>Test mode:</b> Compliance		<b>Verdict:</b> <b>PASS</b>
<b>Date(s):</b> 29-Sep-16 - 05-Oct-16		
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1005 hPa
<b>Remarks:</b> 8DPSK modulation		<b>Power:</b> 120 VAC

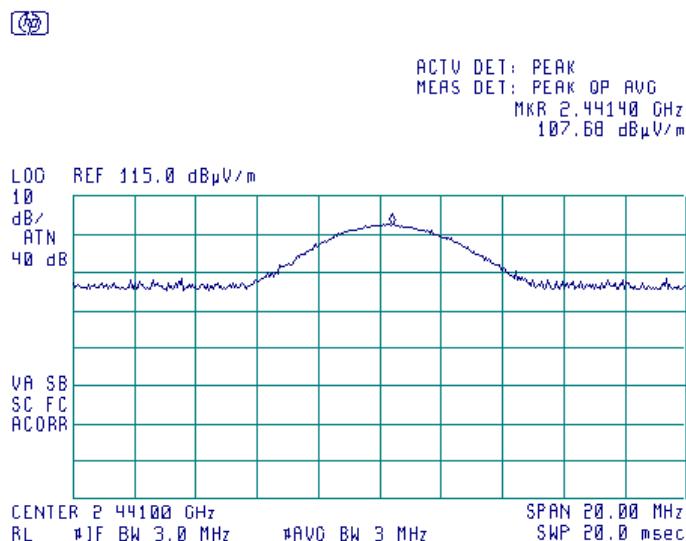
**Plot 7.5.9 Field strength of carrier at mid frequency vertical antenna polarization**

EUT POSITION: Z-axis



**Plot 7.5.10 Field strength of carrier at mid frequency horizontal antenna polarization**

EUT POSITION: X-axis



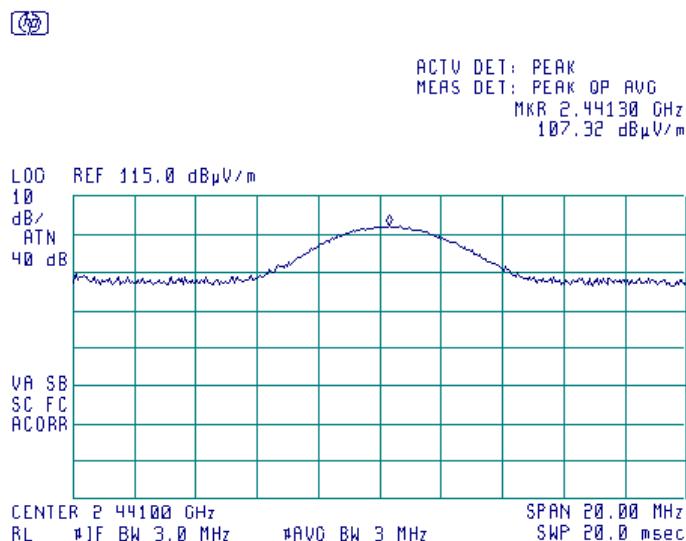


HERMON LABORATORIES

<b>Test specification: Section 15.247(b), Peak output power</b>			
<b>Test procedure:</b> ANSI C63.10, section 7.8.5			
<b>Test mode:</b> Compliance			<b>Verdict:</b> PASS
<b>Date(s):</b> 29-Sep-16 - 05-Oct-16			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1005 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b> 8DPSK modulation			

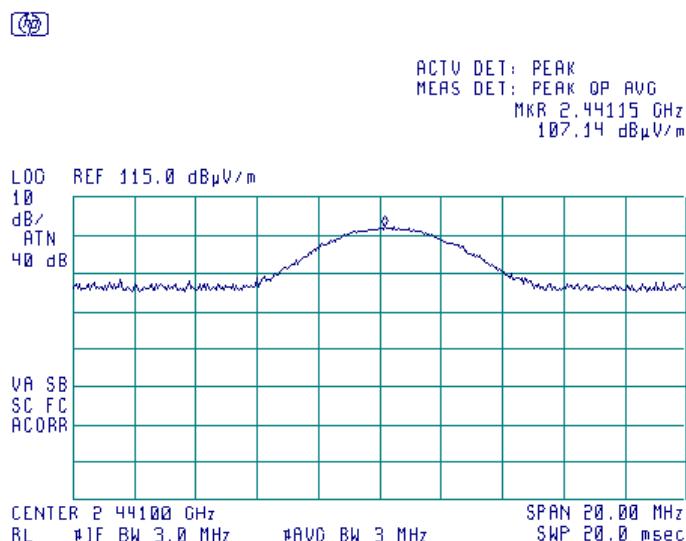
**Plot 7.5.11 Field strength of carrier at mid frequency horizontal antenna polarization**

EUT POSITION: Y-axis



**Plot 7.5.12 Field strength of carrier at mid frequency horizontal antenna polarization**

EUT POSITION: Z-axis



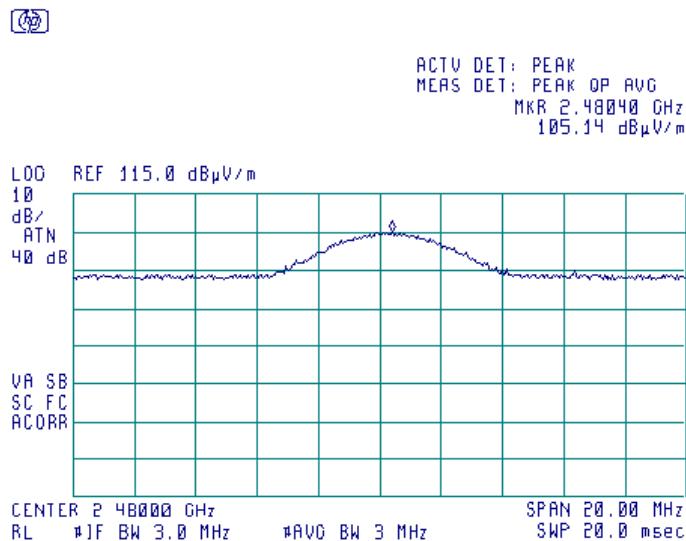


HERMON LABORATORIES

<b>Test specification: Section 15.247(b), Peak output power</b>		
<b>Test procedure:</b> ANSI C63.10, section 7.8.5		
<b>Test mode:</b> Compliance		<b>Verdict:</b> <b>PASS</b>
<b>Date(s):</b> 29-Sep-16 - 05-Oct-16		
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1005 hPa
<b>Remarks:</b> 8DPSK modulation		

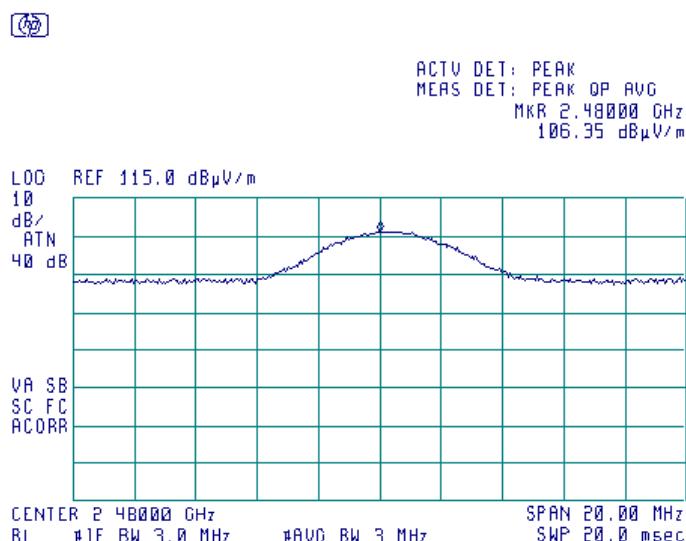
**Plot 7.5.13 Field strength of carrier at high frequency vertical antenna polarization**

EUT POSITION: X-axis



**Plot 7.5.14 Field strength of carrier at high frequency vertical antenna polarization**

EUT POSITION: Y-axis



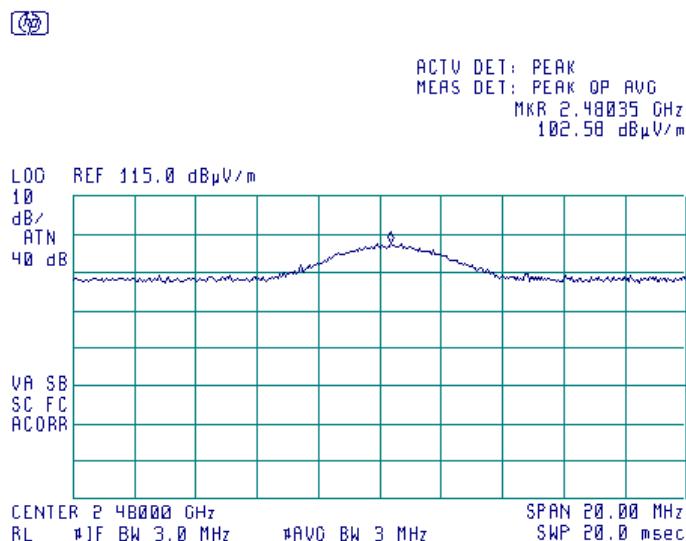


HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b), Peak output power		
<b>Test procedure:</b> ANSI C63.10, section 7.8.5		
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS
<b>Date(s):</b> 29-Sep-16 - 05-Oct-16		
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1005 hPa
<b>Remarks:</b> 8DPSK modulation		<b>Power:</b> 120 VAC

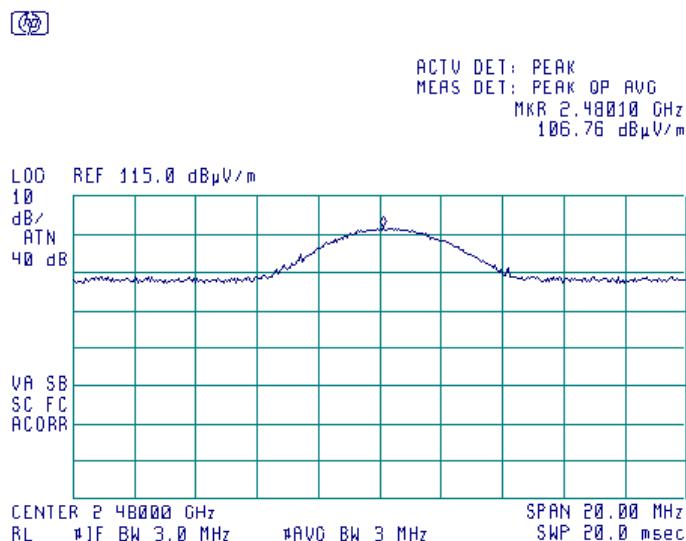
**Plot 7.5.15 Field strength of carrier at high frequency vertical antenna polarization**

EUT POSITION: Z-axis



**Plot 7.5.16 Field strength of carrier at high frequency horizontal antenna polarization**

EUT POSITION: X-axis



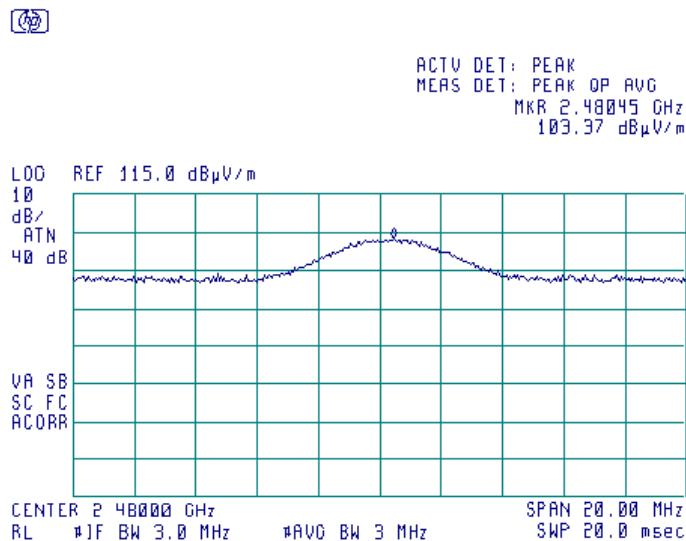


HERMON LABORATORIES

Test specification: Section 15.247(b), Peak output power			
Test procedure: ANSI C63.10, section 7.8.5			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Sep-16 - 05-Oct-16			
Temperature: 24 °C	Relative Humidity: 44 %	Air Pressure: 1005 hPa	Power: 120 VAC
Remarks: 8DPSK modulation			

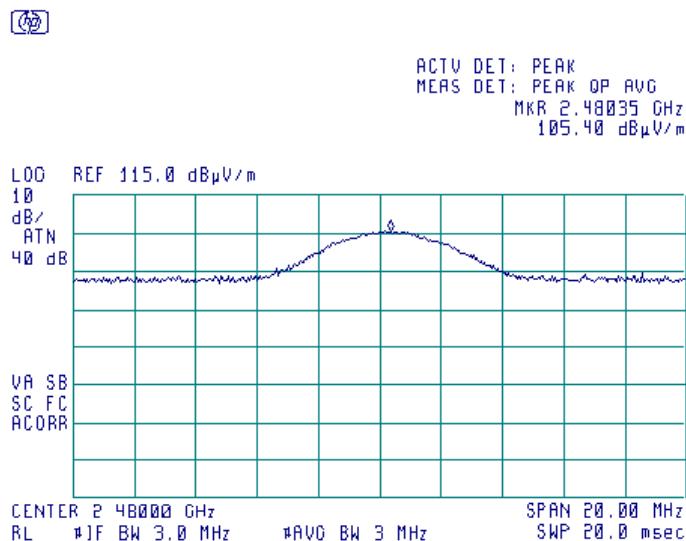
**Plot 7.5.17 Field strength of carrier at high frequency horizontal antenna polarization**

EUT POSITION: Y-axis



**Plot 7.5.18 Field strength of carrier at high frequency horizontal antenna polarization**

EUT POSITION: Z-axis





HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b), Peak output power			
<b>Test procedure:</b> ANSI C63.10, section 7.8.5			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 29-Sep-16 - 05-Oct-16			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1005 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b> DQPSK modulation			

## 7.6 Peak output power at DQPSK modulation

### 7.6.1 General

This test was performed to measure the maximum peak output power radiated by transmitter. Specification test limits are given in Table 7.6.1.

Table 7.6.1 Peak output power limits

Assigned frequency range, MHz	Peak output power*		Equivalent field strength limit @ 3m, dB(µV/m)*	Maximum antenna gain, dBi
	W	dBm		
902.0 – 928.0	0.25 (<50 hopping channels)	24.0(<50 hopping channels)	125.2 (<50 hopping channels)	6.0*
	1.0 (≥50 hopping channels)	30.0 (≥50 hopping channels)	131.2 (≥50 hopping channels)	
2400.0 – 2483.5	0.125 (<75 hopping channels)	21.0(<75 hopping channels)	122.2 (<75 hopping channels)	6.0*
	1.0 (≥75 hopping channels)	30.0 (≥75 hopping channels)	131.2 (≥75 hopping channels)	
5725.0 – 5850.0	1.0	30.0	131.2	

\*- Equivalent field strength limit was calculated from the peak output power as follows:  $E = \sqrt{30 \times P \times G} / r$ , where P is peak output power in Watts, r is antenna to EUT distance in meters and G is transmitter antenna gain in dBi.

\*\*- The limit is provided in terms of conducted RF power at the antenna connector. If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power limit shall be reduced below the stated value as follows:

- by 1 dB for every 3 dB that the directional gain of antenna exceeds 6 dBi for fixed point-to-point transmitters operate in 2400-2483.5 MHz band;
- without any corresponding reduction for fixed point-to-point transmitters operate in 5725-5850 MHz band;
- by the amount in dB that the directional gain of antenna exceeds 6 dBi for the rest of transmitters.

### 7.6.2 Test procedure

- 7.6.2.1 The EUT was set up as shown in Figure 7.6.1, energized and its proper operation was checked.
- 7.6.2.2 The EUT was adjusted to produce maximum available to end user RF output power.
- 7.6.2.3 The frequency span of spectrum analyzer was set approximately 5 times wider than 20 dB bandwidth of the EUT and the resolution bandwidth was set wider than 20 dB bandwidth of the EUT. To find maximum radiation the turntable was rotated 360° and the measuring antenna height was swept in both vertical and horizontal polarizations.
- 7.6.2.4 The maximum field strength of the EUT carrier frequency was measured as provided in Table 7.6.2 and associated plots.
- 7.6.2.5 The maximum peak output power was calculated from the field strength of carrier as follows:

$$P = (E \times d)^2 / (30 \times G),$$

where P is the peak output power in W, E is the field strength in V/m, d is the test distance and G is the transmitter numeric antenna gain over an isotropic radiator.

The above equation was converted in logarithmic units for 3 m test distance:

$$\text{Peak output power in dBm} = \text{Field strength in dB}(\mu\text{V}/\text{m}) - \text{Transmitter antenna gain in dBi} - 95.2 \text{ dB}$$

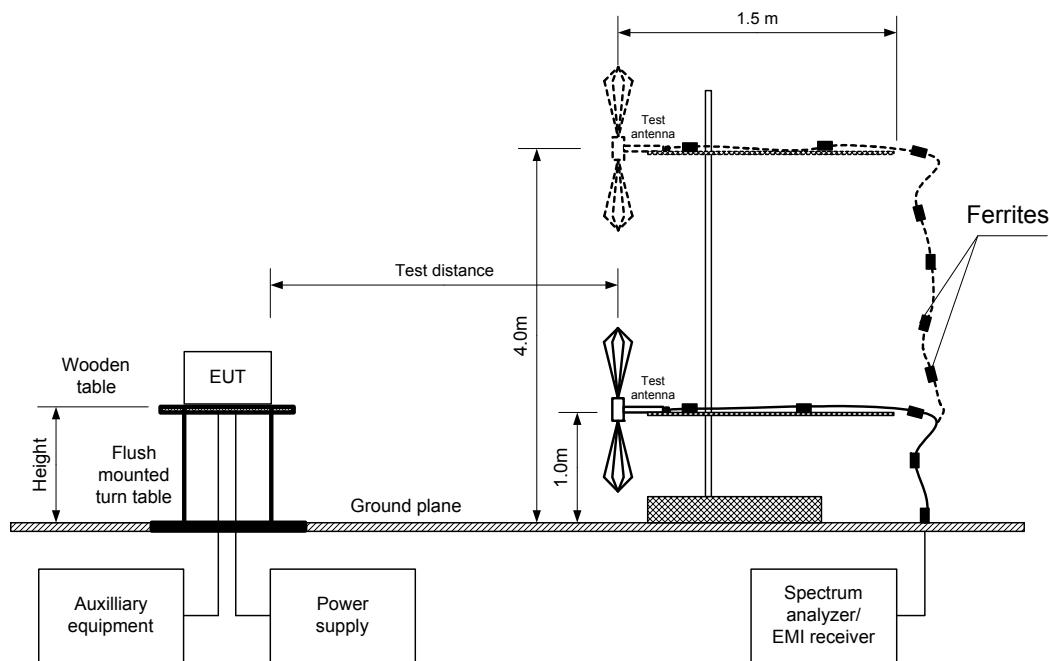
- 7.6.2.6 The worst test results (the lowest margins) were recorded in Table 7.6.2.



HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b), Peak output power		
<b>Test procedure:</b> ANSI C63.10, section 7.8.5		
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS
<b>Date(s):</b> 29-Sep-16 - 05-Oct-16		
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1005 hPa
<b>Remarks:</b> DQPSK modulation		

Figure 7.6.1 Setup for carrier field strength measurements





HERMON LABORATORIES

Test specification: Section 15.247(b), Peak output power		
Test procedure:	ANSI C63.10, section 7.8.5	
Test mode:	Compliance	Verdict: PASS
Date(s):	29-Sep-16 - 05-Oct-16	
Temperature: 24 °C	Relative Humidity: 44 %	Air Pressure: 1005 hPa
Remarks: DQPSK modulation		Power: 120 VAC

Table 7.6.2 Peak output power test results

ASSIGNED FREQUENCY: 2400-2483.5 MHz  
 TEST DISTANCE: 3 m  
 TEST SITE: Semi anechoic chamber  
 EUT HEIGHT: 1.5 m  
 DETECTOR USED: Peak  
 TEST ANTENNA TYPE: Biconilog (30 MHz – 1000 MHz)  
 Double ridged guide (above 1000 MHz)  
 MODULATION: DQPSK-  
 MODULATING SIGNAL: PRBS  
 BIT RATE: 3 Mbps  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
 DETECTOR USED: Peak  
 EUT 20 dB BANDWIDTH: 1.379 MHz  
 RESOLUTION BANDWIDTH: 3 MHz  
 VIDEO BANDWIDTH: 3 MHz  
 FREQUENCY HOPPING: Disabled  
 NUMBER OF FREQUENCY HOPPING CHANNELS:

Frequency, MHz	Field strength, dB(µV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	EUT antenna gain, dBi	Peak output power, dBm**	Limit, dBm	Margin, dB***	Verdict
2402	110.63	Horizontal	1.7	10	1.72	13.71	30	-16.29	Pass
2441	106.50	Horizontal	1.7	10	1.72	9.58	30	-20.42	Pass
2480	105.27	Horizontal	1.8	20	1.72	8.35	30	-21.65	Pass

\*- EUT front panel refer to 0 degrees position of turntable.

\*\*- Peak output power was calculated from the field strength of carrier as follows:  $P = (E \times d)^2 / (30 \times G)$ , where P is the peak output power in W, E is the field strength in V/m, d is the test distance in meters and G is the transmitter numeric antenna gain over an isotropic radiator. The above equation was converted in logarithmic units for 3 m test distance: Peak output power in dBm = Field strength in dB(µV/m) - Transmitter antenna gain in dBi - 95.2 dB

\*\*\*- Margin = Peak output power – specification limit.

## Reference numbers of test equipment used

HL 0521	HL 1984	HL 4353	HL 5101				
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Full description is given in Appendix A.

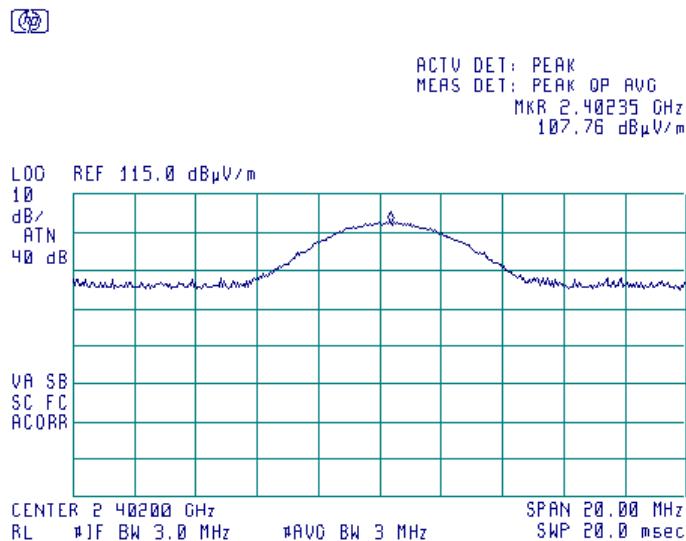


HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b), Peak output power		
<b>Test procedure:</b> ANSI C63.10, section 7.8.5		
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS	
<b>Date(s):</b> 29-Sep-16 - 05-Oct-16		
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1005 hPa
<b>Remarks:</b> DQPSK modulation		

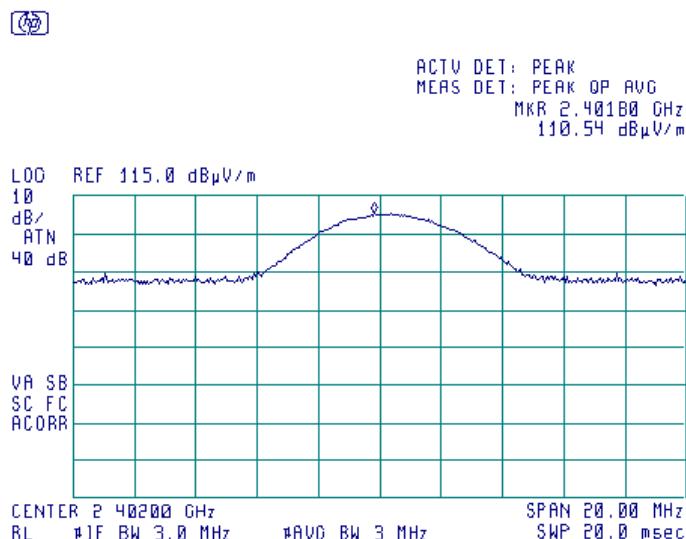
**Plot 7.6.1 Field strength of carrier at low frequency vertical antenna polarization**

EUT POSITION: X-axis



**Plot 7.6.2 Field strength of carrier at low frequency vertical antenna polarization**

EUT POSITION: Y-axis



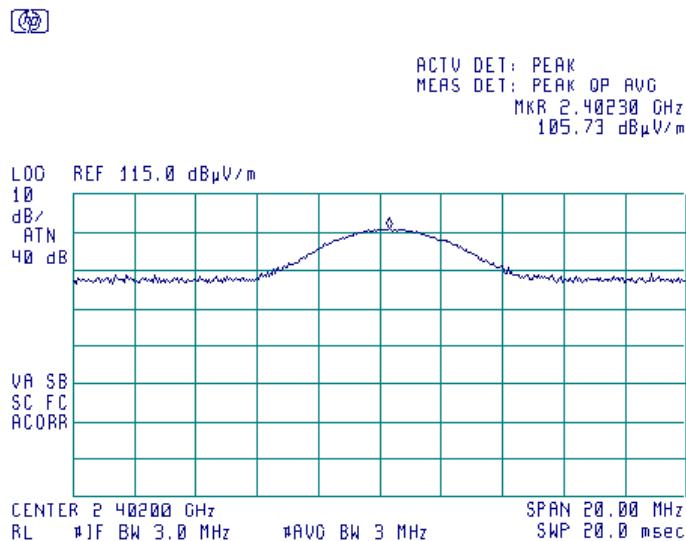


HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b), Peak output power		
<b>Test procedure:</b> ANSI C63.10, section 7.8.5		
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS	
<b>Date(s):</b> 29-Sep-16 - 05-Oct-16		
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1005 hPa
<b>Remarks:</b> DQPSK modulation		

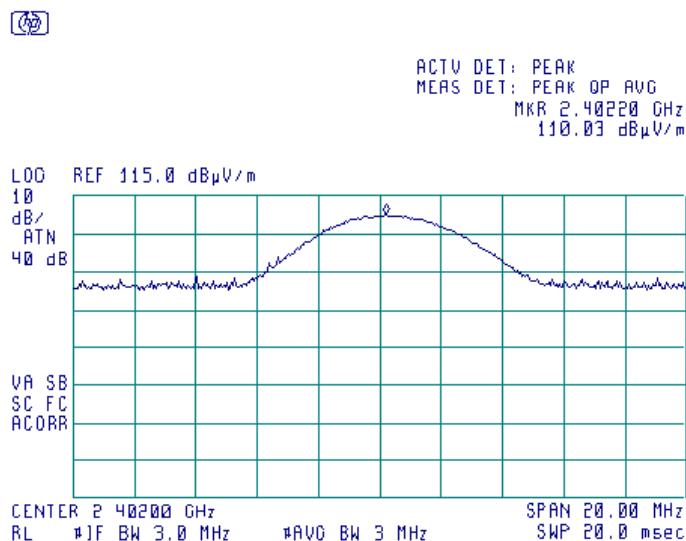
**Plot 7.6.3 Field strength of carrier at low frequency vertical antenna polarization**

EUT POSITION: Z-axis



**Plot 7.6.4 Field strength of carrier at low frequency horizontal antenna polarization**

EUT POSITION: X-axis



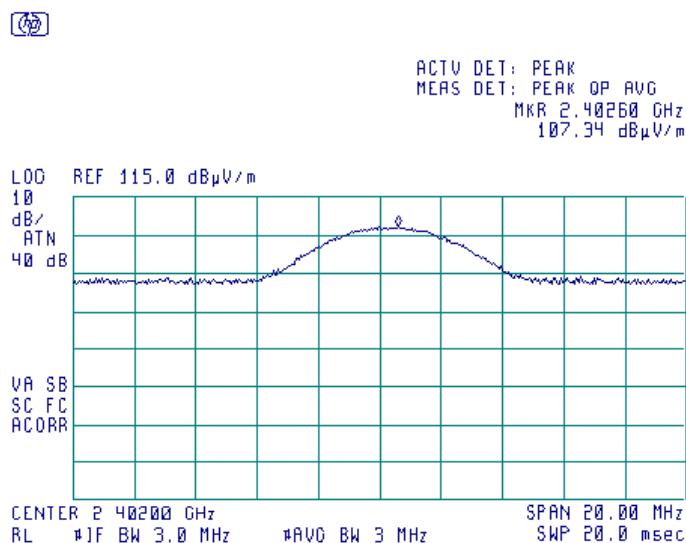


HERMON LABORATORIES

<b>Test specification: Section 15.247(b), Peak output power</b>		
<b>Test procedure:</b> ANSI C63.10, section 7.8.5		
<b>Test mode:</b> Compliance	<b>Verdict:</b> <b>PASS</b>	
<b>Date(s):</b> 29-Sep-16 - 05-Oct-16		
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1005 hPa
<b>Remarks:</b> DQPSK modulation		

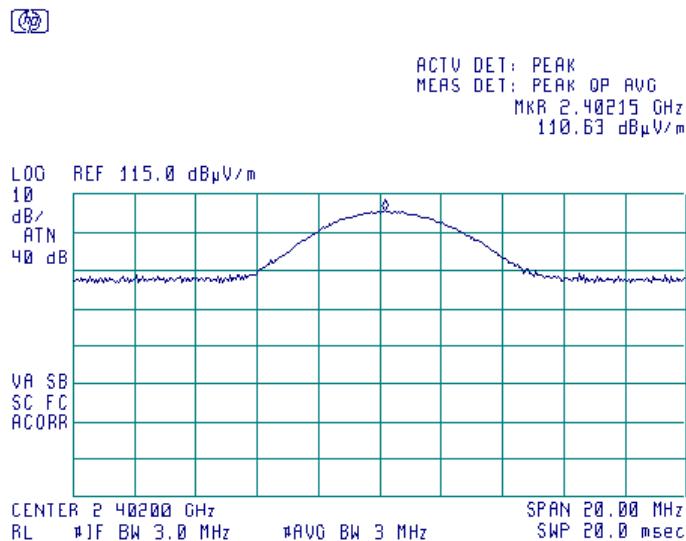
**Plot 7.6.5 Field strength of carrier at low frequency horizontal antenna polarization**

EUT POSITION: Y-axis



**Plot 7.6.6 Field strength of carrier at low frequency horizontal antenna polarization**

EUT POSITION: Z-axis



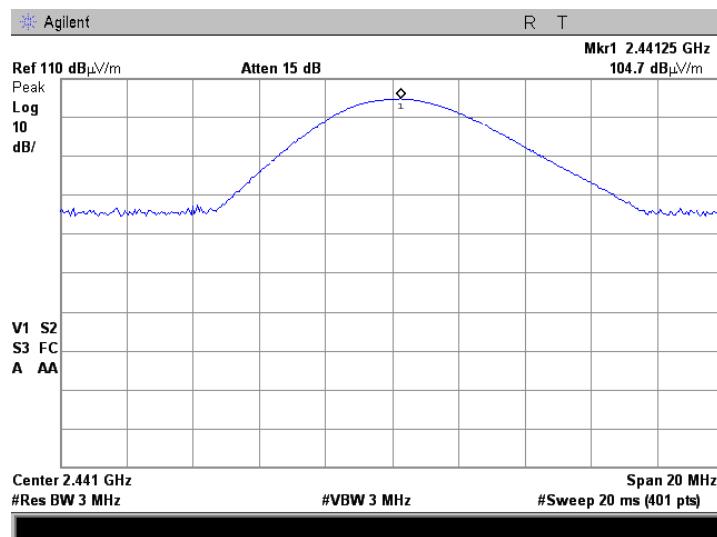


HERMON LABORATORIES

<b>Test specification: Section 15.247(b), Peak output power</b>		
<b>Test procedure:</b> ANSI C63.10, section 7.8.5		
<b>Test mode:</b> Compliance		<b>Verdict:</b> <b>PASS</b>
<b>Date(s):</b> 29-Sep-16 - 05-Oct-16		
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1005 hPa
<b>Remarks:</b> DQPSK modulation		

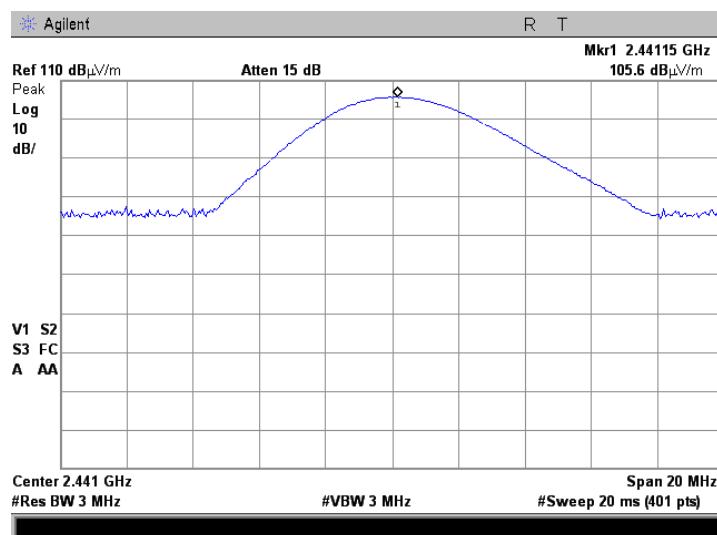
**Plot 7.6.7 Field strength of carrier at mid frequency vertical antenna polarization**

EUT POSITION: X-axis



**Plot 7.6.8 Field strength of carrier at mid frequency vertical antenna polarization**

EUT POSITION: Y-axis



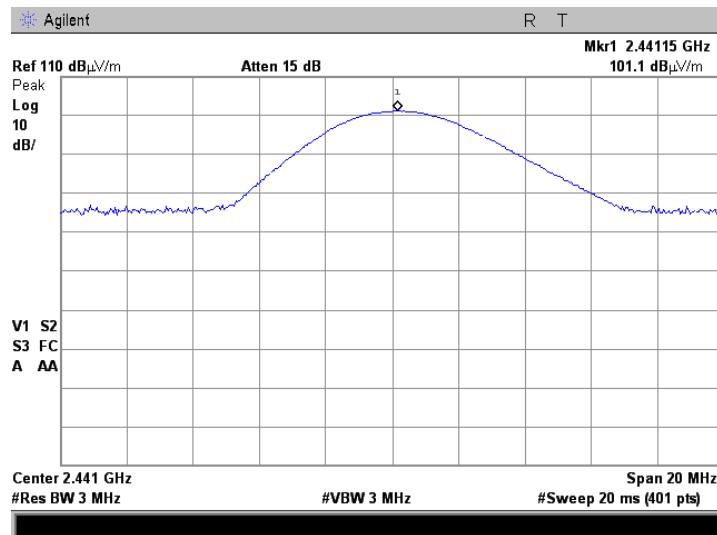


HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b), Peak output power		
<b>Test procedure:</b> ANSI C63.10, section 7.8.5		
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS
<b>Date(s):</b> 29-Sep-16 - 05-Oct-16		
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1005 hPa
<b>Remarks:</b> DQPSK modulation		

**Plot 7.6.9 Field strength of carrier at mid frequency vertical antenna polarization**

EUT POSITION: Z-axis



**Plot 7.6.10 Field strength of carrier at mid frequency horizontal antenna polarization**

EUT POSITION: X-axis



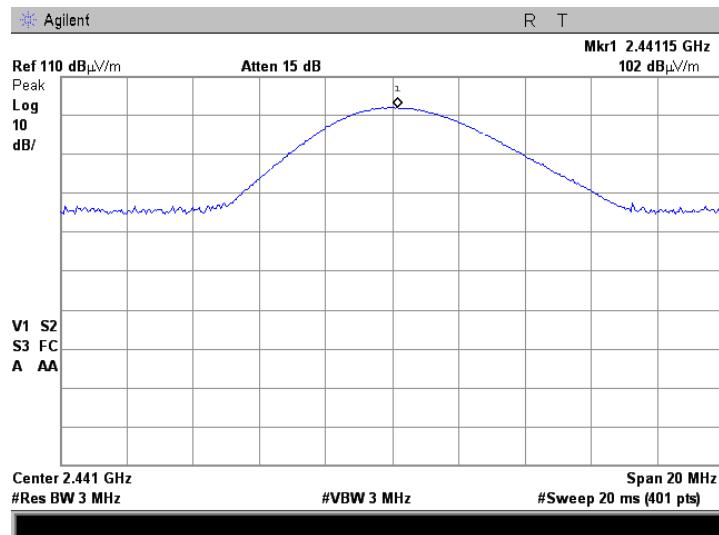


HERMON LABORATORIES

<b>Test specification: Section 15.247(b), Peak output power</b>		
<b>Test procedure:</b> ANSI C63.10, section 7.8.5		
<b>Test mode:</b> Compliance		<b>Verdict:</b> <b>PASS</b>
<b>Date(s):</b> 29-Sep-16 - 05-Oct-16		
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1005 hPa
<b>Remarks:</b> DQPSK modulation		

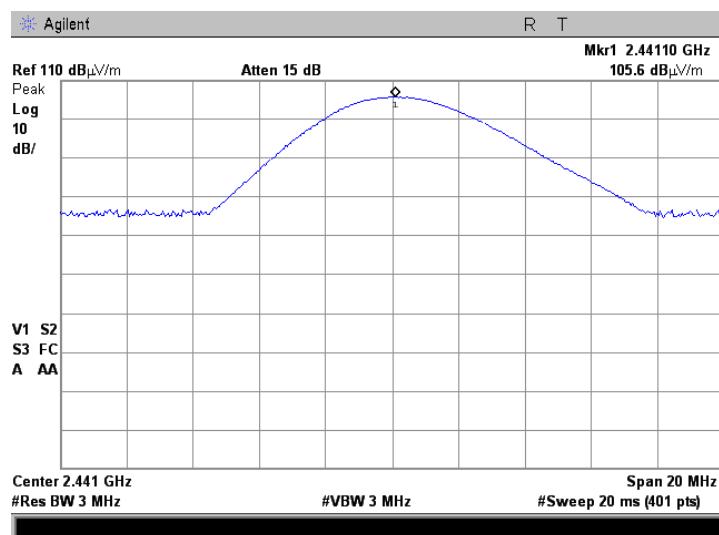
**Plot 7.6.11 Field strength of carrier at mid frequency horizontal antenna polarization**

EUT POSITION: Y-axis



**Plot 7.6.12 Field strength of carrier at mid frequency horizontal antenna polarization**

EUT POSITION: Z-axis



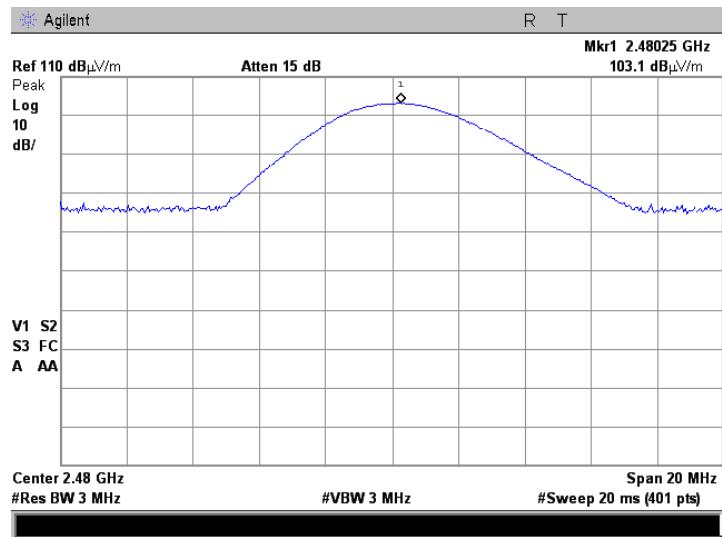


HERMON LABORATORIES

<b>Test specification: Section 15.247(b), Peak output power</b>		
<b>Test procedure:</b> ANSI C63.10, section 7.8.5		
<b>Test mode:</b> Compliance		<b>Verdict:</b> <b>PASS</b>
<b>Date(s):</b> 29-Sep-16 - 05-Oct-16		
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1005 hPa
<b>Remarks:</b> DQPSK modulation		

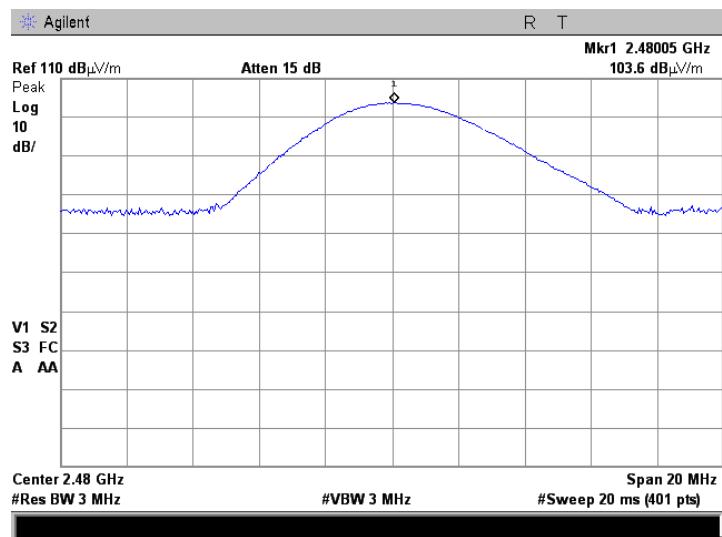
**Plot 7.6.13 Field strength of carrier at high frequency vertical antenna polarization**

EUT POSITION: X-axis



**Plot 7.6.14 Field strength of carrier at high frequency vertical antenna polarization**

EUT POSITION: Y-axis



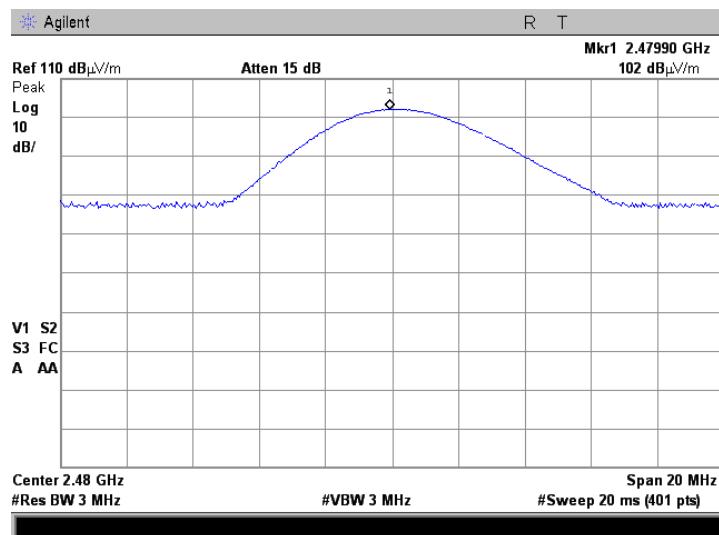


HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b), Peak output power		
<b>Test procedure:</b> ANSI C63.10, section 7.8.5		
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS
<b>Date(s):</b> 29-Sep-16 - 05-Oct-16		
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1005 hPa
<b>Remarks:</b> DQPSK modulation		

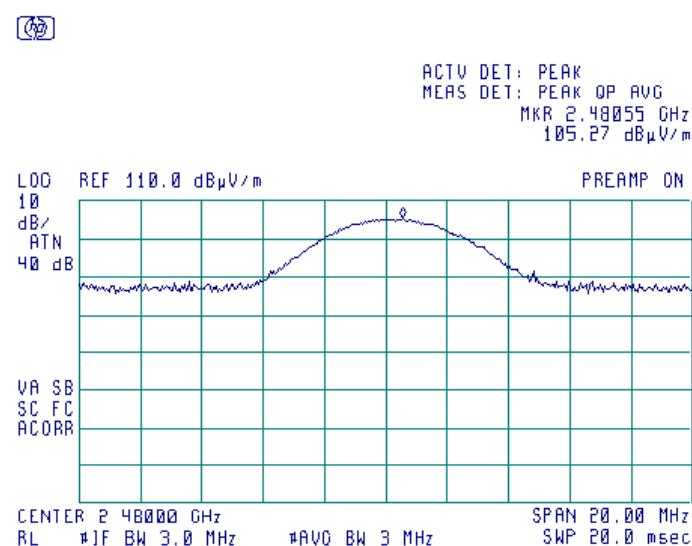
**Plot 7.6.15 Field strength of carrier at high frequency vertical antenna polarization**

EUT POSITION: Z-axis



**Plot 7.6.16 Field strength of carrier at high frequency horizontal antenna polarization**

EUT POSITION: X-axis



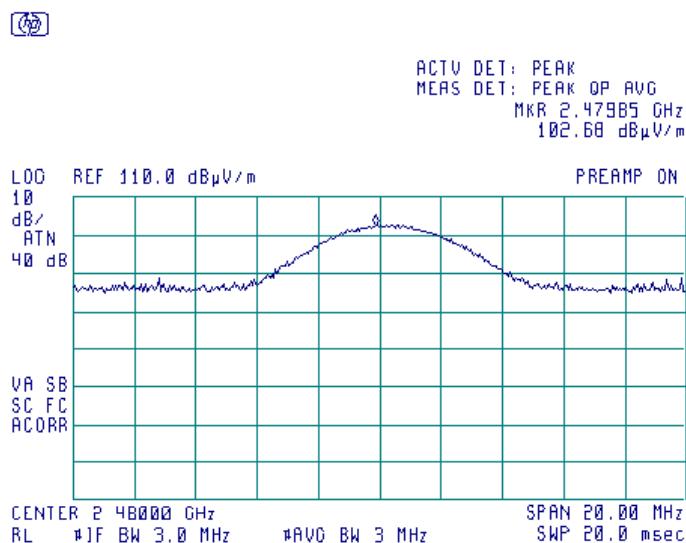


HERMON LABORATORIES

<b>Test specification: Section 15.247(b), Peak output power</b>		
<b>Test procedure:</b> ANSI C63.10, section 7.8.5		
<b>Test mode:</b> Compliance	<b>Verdict:</b> <b>PASS</b>	
<b>Date(s):</b> 29-Sep-16 - 05-Oct-16		
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1005 hPa
<b>Remarks:</b> DQPSK modulation		<b>Power:</b> 120 VAC

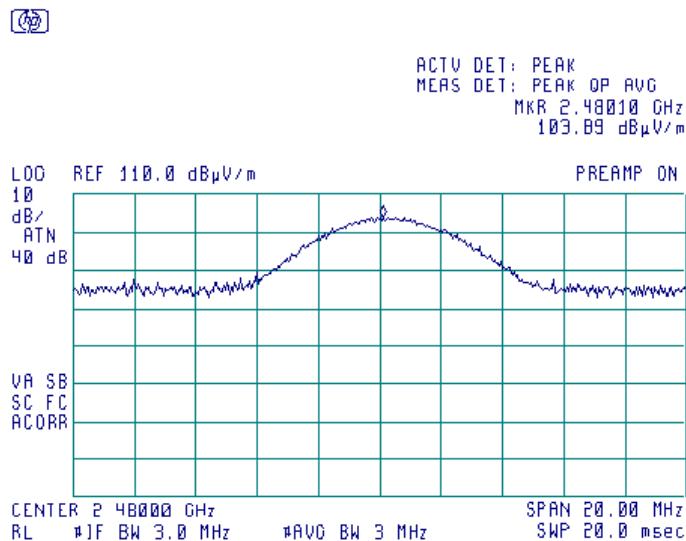
**Plot 7.6.17 Field strength of carrier at high frequency horizontal antenna polarization**

EUT POSITION: Y-axis



**Plot 7.6.18 Field strength of carrier at high frequency horizontal antenna polarization**

EUT POSITION: Z-axis





HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b), Peak output power			
<b>Test procedure:</b> ANSI C63.10, section 7.8.5			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 29-Sep-16			
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1005 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b> GFSK modulation			

## 7.7 Peak output power at GFSK modulation

### 7.7.1 General

This test was performed to measure the maximum peak output power radiated by transmitter. Specification test limits are given in Table 7.7.1.

Table 7.7.1 Peak output power limits

Assigned frequency range, MHz	Peak output power*		Equivalent field strength limit @ 3m, dB(µV/m)*	Maximum antenna gain, dBi
	W	dBm		
902.0 – 928.0	0.25 (<50 hopping channels)	24.0(<50 hopping channels)	125.2 (<50 hopping channels)	6.0*
	1.0 (≥50 hopping channels)	30.0 (≥50 hopping channels)	131.2 (≥50 hopping channels)	
2400.0 – 2483.5	0.125 (<75 hopping channels)	21.0(<75 hopping channels)	122.2 (<75 hopping channels)	6.0*
	1.0 (≥75 hopping channels)	30.0 (≥75 hopping channels)	131.2 (≥75 hopping channels)	
5725.0 – 5850.0	1.0	30.0	131.2	

\*- Equivalent field strength limit was calculated from the peak output power as follows:  $E = \sqrt{30 \times P \times G} / r$ , where P is peak output power in Watts, r is antenna to EUT distance in meters and G is transmitter antenna gain in dBi.

\*\*- The limit is provided in terms of conducted RF power at the antenna connector. If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power limit shall be reduced below the stated value as follows:

- by 1 dB for every 3 dB that the directional gain of antenna exceeds 6 dBi for fixed point-to-point transmitters operate in 2400-2483.5 MHz band;
- without any corresponding reduction for fixed point-to-point transmitters operate in 5725-5850 MHz band;
- by the amount in dB that the directional gain of antenna exceeds 6 dBi for the rest of transmitters.

### 7.7.2 Test procedure

- 7.7.2.1 The EUT was set up as shown in Figure 7.7.1, energized and its proper operation was checked.
- 7.7.2.2 The EUT was adjusted to produce maximum available to end user RF output power.
- 7.7.2.3 The frequency span of spectrum analyzer was set approximately 5 times wider than 20 dB bandwidth of the EUT and the resolution bandwidth was set wider than 20 dB bandwidth of the EUT. To find maximum radiation the turntable was rotated 360° and the measuring antenna height was swept in both vertical and horizontal polarizations.
- 7.7.2.4 The maximum field strength of the EUT carrier frequency was measured as provided in Table 7.7.2 and associated plots.
- 7.7.2.5 The maximum peak output power was calculated from the field strength of carrier as follows:

$$P = (E \times d)^2 / (30 \times G),$$

where P is the peak output power in W, E is the field strength in V/m, d is the test distance and G is the transmitter numeric antenna gain over an isotropic radiator.

The above equation was converted in logarithmic units for 3 m test distance:

$$\text{Peak output power in dBm} = \text{Field strength in dB}(\mu\text{V}/\text{m}) - \text{Transmitter antenna gain in dBi} - 95.2 \text{ dB}$$

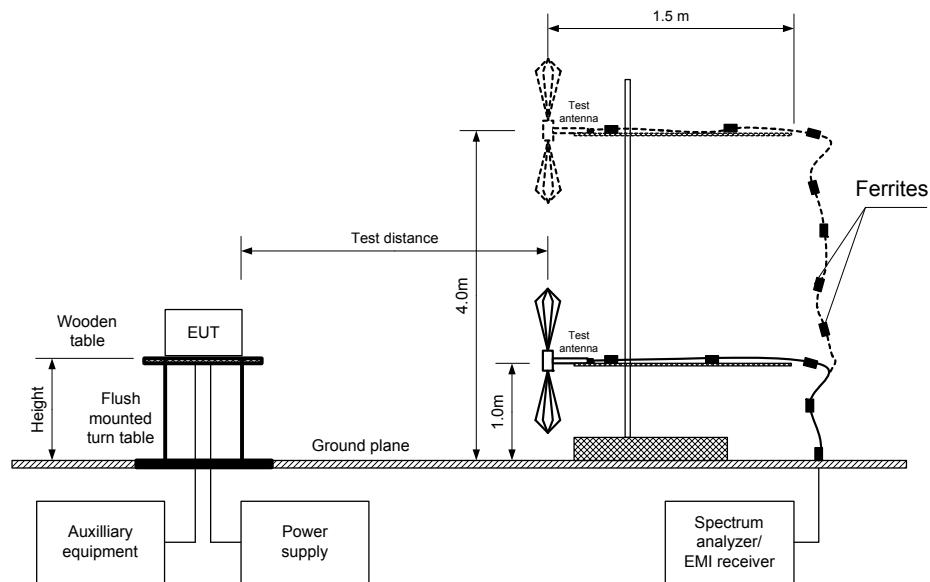
- 7.7.2.6 The worst test results (the lowest margins) were recorded in Table 7.7.2.



HERMON LABORATORIES

<b>Test specification: Section 15.247(b), Peak output power</b>		
<b>Test procedure:</b> ANSI C63.10, section 7.8.5		
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS
<b>Date(s):</b> 29-Sep-16		
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1005 hPa
<b>Remarks:</b> GFSK modulation		<b>Power:</b> 120 VAC

Figure 7.7.1 Setup for carrier field strength measurements





HERMON LABORATORIES

<b>Test specification: Section 15.247(b), Peak output power</b>		
<b>Test procedure:</b>	ANSI C63.10, section 7.8.5	
<b>Test mode:</b>	Compliance	<b>Verdict:</b> PASS
<b>Date(s):</b>	29-Sep-16	
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1005 hPa
<b>Remarks:</b> GFSK modulation		

**Table 7.7.2 Peak output power test results**

ASSIGNED FREQUENCY:	2400-2483.5 MHz
TEST DISTANCE:	3 m
TEST SITE:	Semi anechoic chamber
EUT HEIGHT:	1.5 m
DETECTOR USED:	Peak
TEST ANTENNA TYPE:	Biconilog (30 MHz – 1000 MHz) Double ridged guide (above 1000 MHz)
MODULATION:	GFSK
MODULATING SIGNAL:	PRBS
BIT RATE:	0.925 Mbps
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
DETECTOR USED:	Peak
EUT 20 dB BANDWIDTH:	0.952 MHz
RESOLUTION BANDWIDTH:	1 MHz
VIDEO BANDWIDTH:	3 MHz
FREQUENCY HOPPING:	Disabled
NUMBER OF FREQUENCY HOPPING CHANNELS:	

Frequency, MHz	Field strength, dB(µV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	EUT antenna gain, dBi	Peak output power, dBm**	Limit, dBm	Margin, dB***	Verdict
2402	110.68	Horizontal	1.7	10	1.72	13.76	30	-16.24	Pass
2441	107.63	Horizontal	1.7	10	1.72	10.71	30	-19.29	Pass
2480	106.94	Horizontal	1.8	20	1.72	10.02	30	-19.98	Pass

\*- EUT front panel refer to 0 degrees position of turntable.

\*\*- Peak output power was calculated from the field strength of carrier as follows:  $P = (E \times d)^2 / (30 \times G)$ , where P is the peak output power in W, E is the field strength in V/m, d is the test distance in meters and G is the transmitter numeric antenna gain over an isotropic radiator. The above equation was converted in logarithmic units for 3 m test distance: *Peak output power in dBm = Field strength in dB(µV/m) - Transmitter antenna gain in dBi - 95.2 dB*

\*\*\*- Margin = Peak output power – specification limit.

**Reference numbers of test equipment used**

HL 0521	HL 1984	HL 4353	HL 5101				
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Full description is given in Appendix A.

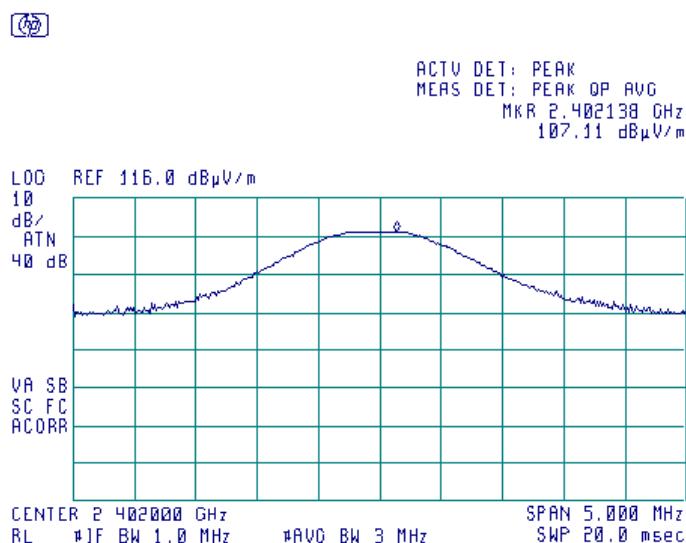


HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b), Peak output power		
<b>Test procedure:</b> ANSI C63.10, section 7.8.5		
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS	
<b>Date(s):</b> 29-Sep-16		
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1005 hPa
<b>Remarks:</b> GFSK modulation		

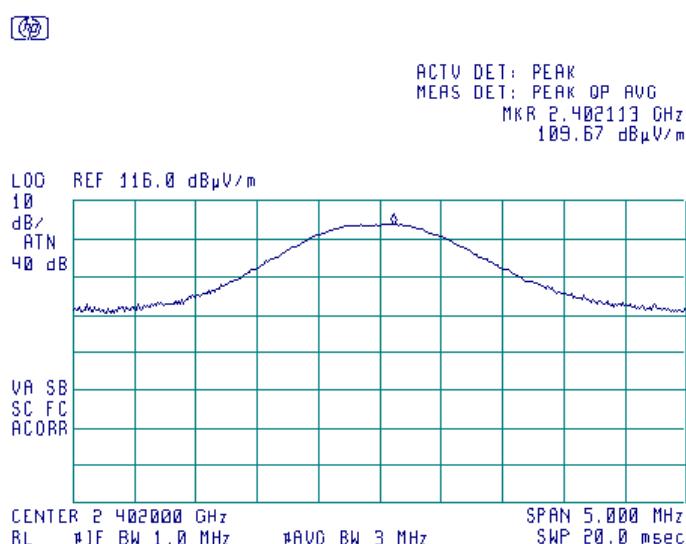
**Plot 7.7.1 Field strength of carrier at low frequency vertical antenna polarization**

EUT POSITION: X-axis



**Plot 7.7.2 Field strength of carrier at low frequency vertical antenna polarization**

EUT POSITION: Y-axis



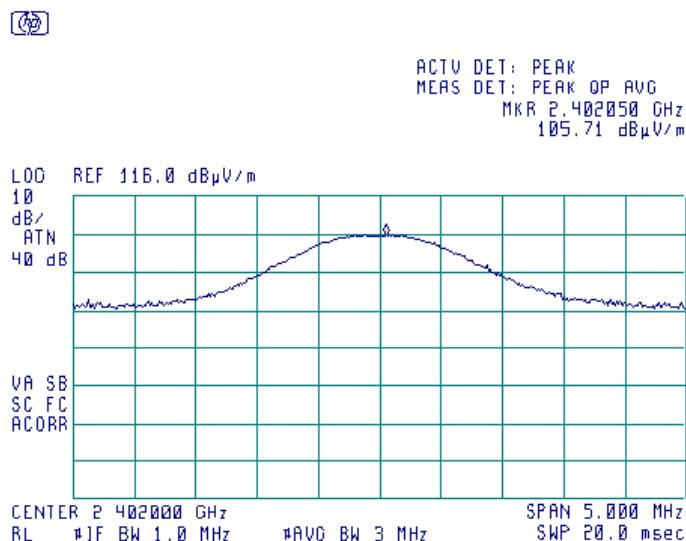


HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b), Peak output power		
<b>Test procedure:</b> ANSI C63.10, section 7.8.5		
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS
<b>Date(s):</b> 29-Sep-16		
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1005 hPa
<b>Remarks:</b> GFSK modulation		<b>Power:</b> 120 VAC

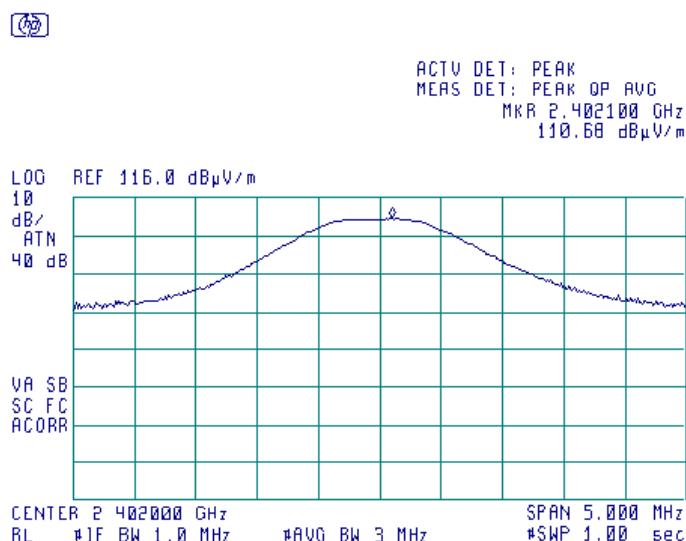
**Plot 7.7.3 Field strength of carrier at low frequency vertical antenna polarization**

EUT POSITION: Z-axis



**Plot 7.7.4 Field strength of carrier at low frequency horizontal antenna polarization**

EUT POSITION: X-axis



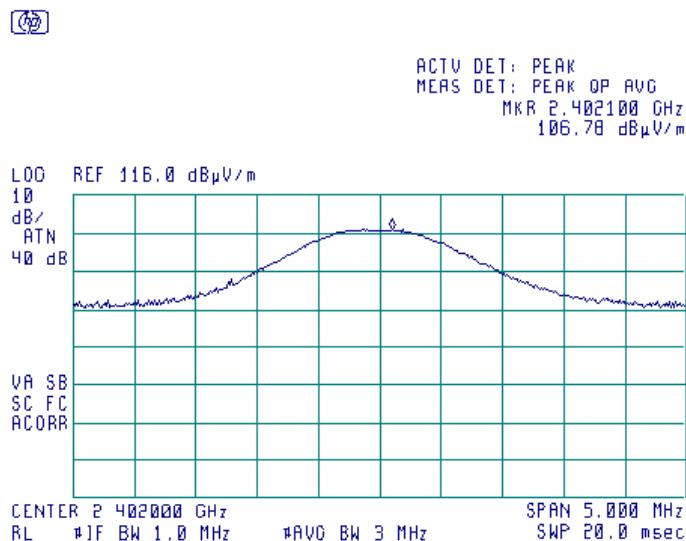


HERMON LABORATORIES

Test specification: <b>Section 15.247(b), Peak output power</b>		
Test procedure: ANSI C63.10, section 7.8.5		
Test mode: Compliance	Verdict: <b>PASS</b>	
Date(s): 29-Sep-16		
Temperature: 24 °C	Air Pressure: 1005 hPa	Power: 120 VAC
Remarks: GFSK modulation		

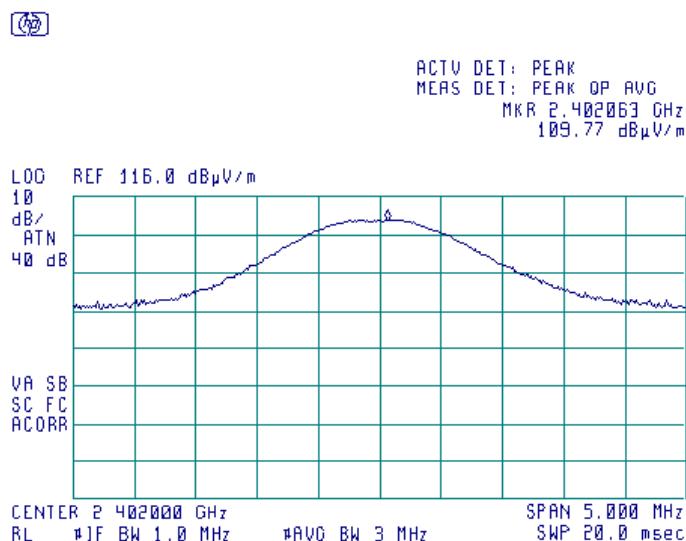
**Plot 7.7.5 Field strength of carrier at low frequency horizontal antenna polarization**

EUT POSITION: Y-axis



**Plot 7.7.6 Field strength of carrier at low frequency horizontal antenna polarization**

EUT POSITION: Z-axis



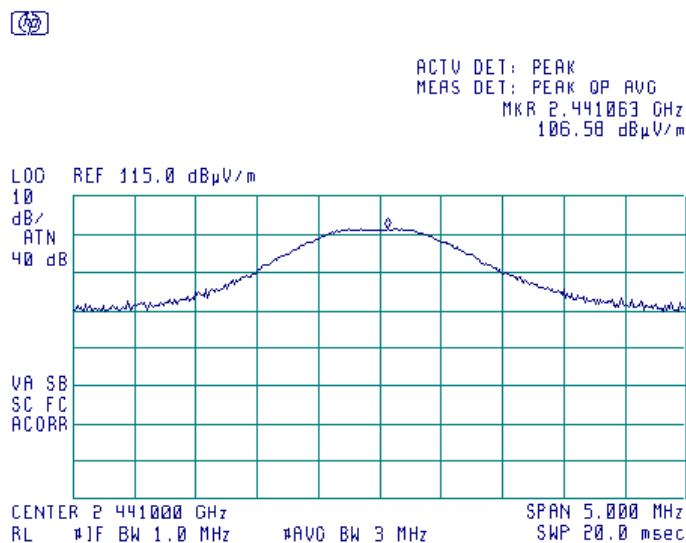


HERMON LABORATORIES

Test specification: <b>Section 15.247(b), Peak output power</b>		
Test procedure: ANSI C63.10, section 7.8.5		
Test mode: Compliance	Date(s): 29-Sep-16	Verdict: <b>PASS</b>
Temperature: 24 °C		Relative Humidity: 44 %
Air Pressure: 1005 hPa		Power: 120 VAC
Remarks: GFSK modulation		

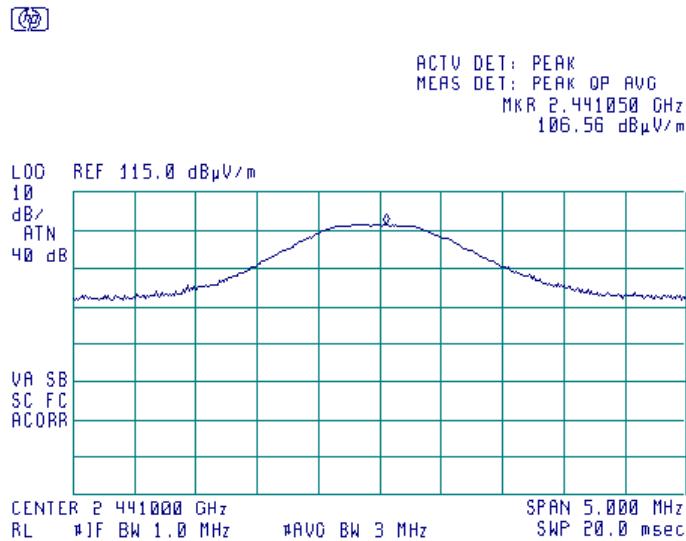
**Plot 7.7.7 Field strength of carrier at mid frequency vertical antenna polarization**

EUT POSITION: X-axis



**Plot 7.7.8 Field strength of carrier at mid frequency vertical antenna polarization**

EUT POSITION: Y-axis



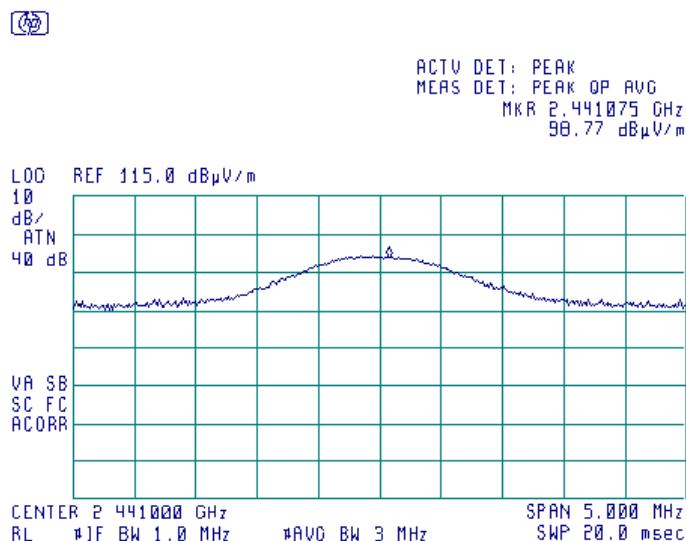


HERMON LABORATORIES

<b>Test specification: Section 15.247(b), Peak output power</b>		
<b>Test procedure:</b> ANSI C63.10, section 7.8.5		
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS
<b>Date(s):</b> 29-Sep-16		
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1005 hPa
<b>Remarks:</b> GFSK modulation		<b>Power:</b> 120 VAC

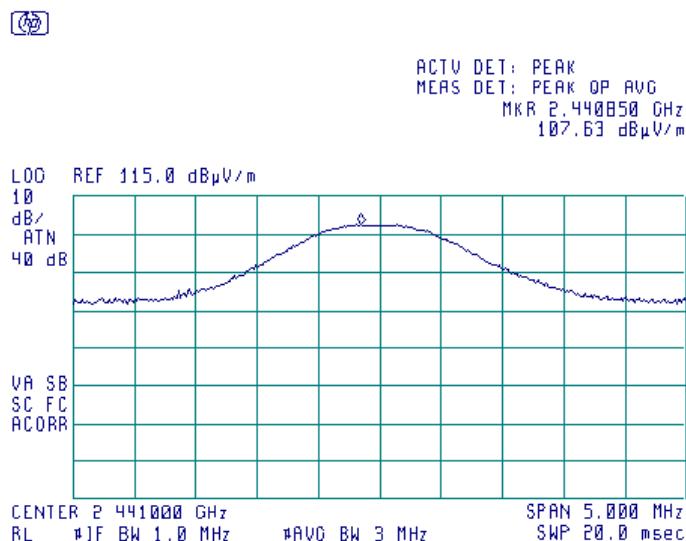
**Plot 7.7.9 Field strength of carrier at mid frequency vertical antenna polarization**

EUT POSITION: Z-axis



**Plot 7.7.10 Field strength of carrier at mid frequency horizontal antenna polarization**

EUT POSITION: X-axis



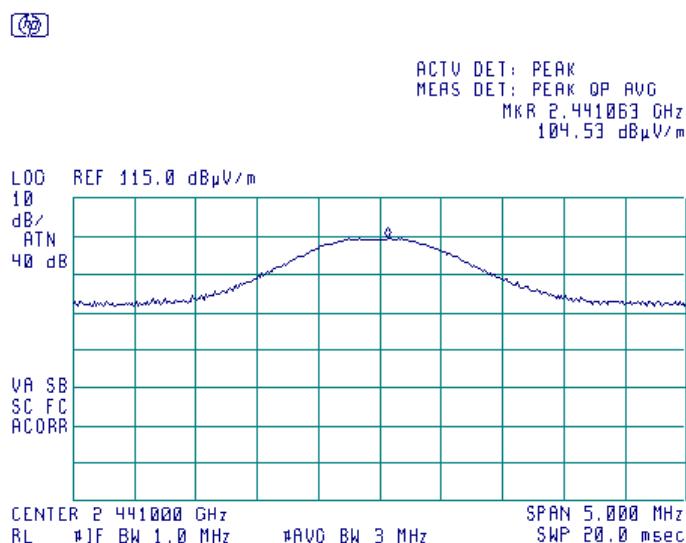


HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b), Peak output power		
<b>Test procedure:</b> ANSI C63.10, section 7.8.5		
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS
<b>Date(s):</b> 29-Sep-16		
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1005 hPa
<b>Remarks:</b> GFSK modulation		

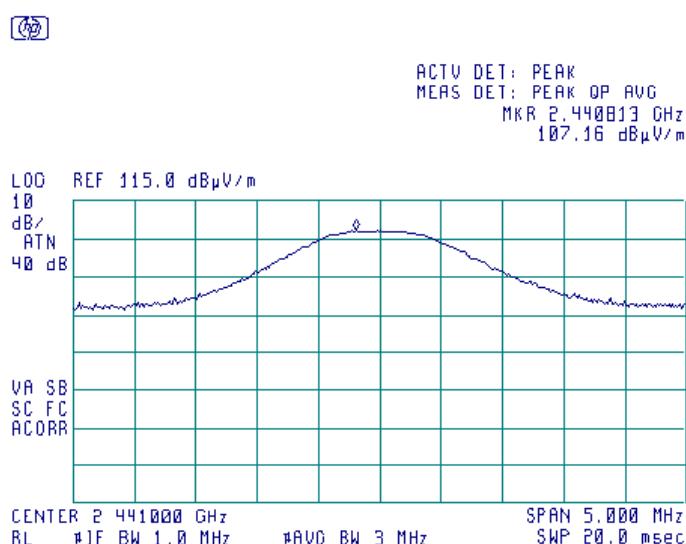
**Plot 7.7.11 Field strength of carrier at mid frequency horizontal antenna polarization**

EUT POSITION: Y-axis



**Plot 7.7.12 Field strength of carrier at mid frequency horizontal antenna polarization**

EUT POSITION: Z-axis



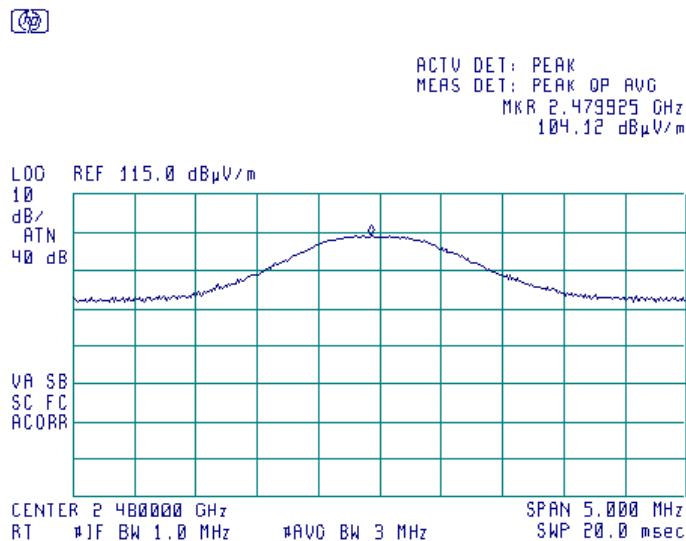


HERMON LABORATORIES

<b>Test specification: Section 15.247(b), Peak output power</b>		
<b>Test procedure:</b> ANSI C63.10, section 7.8.5		
<b>Test mode:</b> Compliance	<b>Verdict:</b> <b>PASS</b>	
<b>Date(s):</b> 29-Sep-16		
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1005 hPa
<b>Remarks:</b> GFSK modulation		

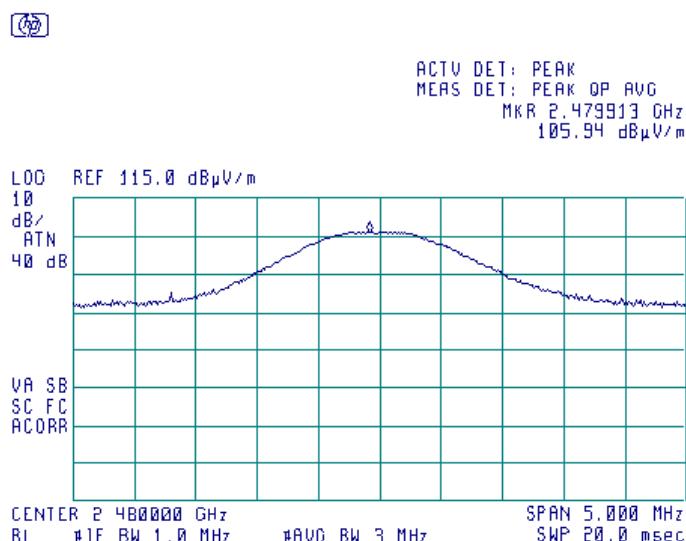
**Plot 7.7.13 Field strength of carrier at high frequency vertical antenna polarization**

EUT POSITION: X-axis



**Plot 7.7.14 Field strength of carrier at high frequency vertical antenna polarization**

EUT POSITION: Y-axis



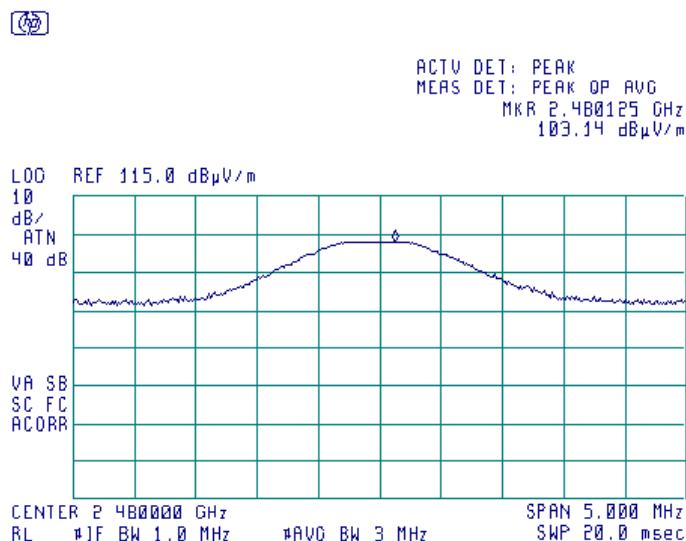


HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b), Peak output power		
<b>Test procedure:</b> ANSI C63.10, section 7.8.5		
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS
<b>Date(s):</b>	29-Sep-16	
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1005 hPa
<b>Remarks:</b> GFSK modulation		

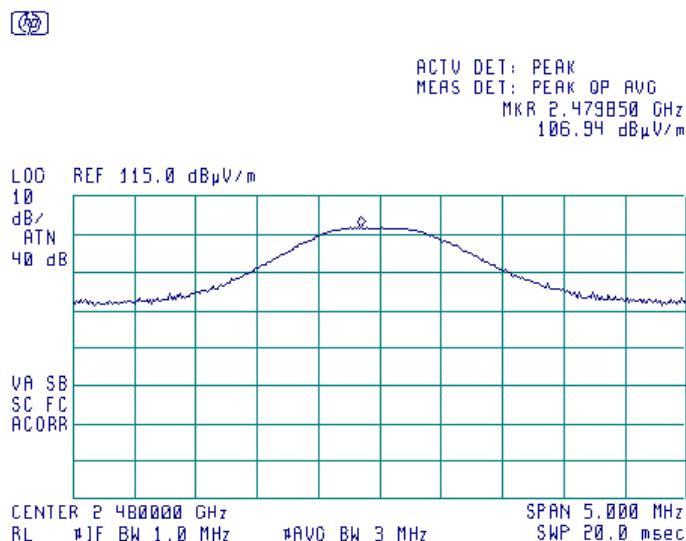
**Plot 7.7.15 Field strength of carrier at high frequency vertical antenna polarization**

EUT POSITION: Z-axis



**Plot 7.7.16 Field strength of carrier at high frequency horizontal antenna polarization**

EUT POSITION: X-axis



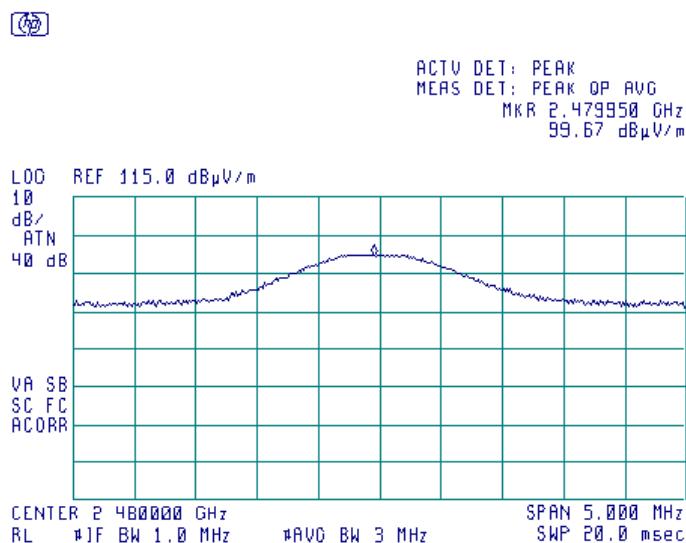


HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b), Peak output power		
<b>Test procedure:</b> ANSI C63.10, section 7.8.5		
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS
<b>Date(s):</b> 29-Sep-16		
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1005 hPa
<b>Remarks:</b> GFSK modulation		

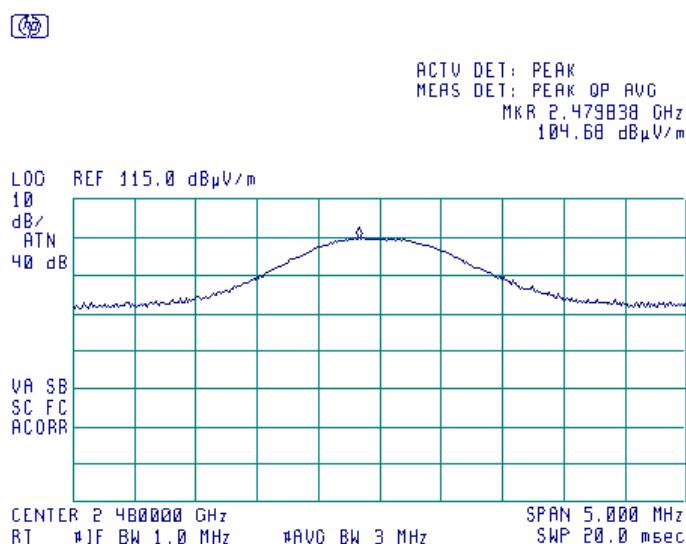
**Plot 7.7.17 Field strength of carrier at high frequency horizontal antenna polarization**

EUT POSITION: Y-axis



**Plot 7.7.18 Field strength of carrier at high frequency horizontal antenna polarization**

EUT POSITION: Z-axis





HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b), Peak output power	
<b>Test procedure:</b>	ANSI C63.10, section 7.8.5
<b>Test mode:</b>	Compliance
<b>Date(s):</b>	05-Oct-16
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 40 %
	<b>Air Pressure:</b> 1005 hPa
<b>Remarks:</b> BLE(GFSK) modulation	
<b>Verdict:</b> PASS	

## 7.8 Peak output power at BLE (GFSK) modulation

### 7.8.1 General

This test was performed to measure the maximum peak output power radiated by transmitter. Specification test limits are given in Table 7.8.1.

Table 7.8.1 Peak output power limits

Assigned frequency range, MHz	Peak output power*		Equivalent field strength limit @ 3m, dB(µV/m)*	Maximum antenna gain, dBi
	W	dBm		
902.0 – 928.0	0.25 (<50 hopping channels)	24.0(<50 hopping channels)	125.2 (<50 hopping channels)	6.0*
	1.0 (≥50 hopping channels)	30.0 (≥50 hopping channels)	131.2 (≥50 hopping channels)	
2400.0 – 2483.5	0.125 (<75 hopping channels)	21.0(<75 hopping channels)	122.2 (<75 hopping channels)	6.0*
	1.0 (≥75 hopping channels)	30.0 (≥75 hopping channels)	131.2 (≥75 hopping channels)	
5725.0 – 5850.0	1.0	30.0	131.2	

\*- Equivalent field strength limit was calculated from the peak output power as follows:  $E = \sqrt{30 \times P \times G} / r$ , where P is peak output power in Watts, r is antenna to EUT distance in meters and G is transmitter antenna gain in dBi.

\*\*- The limit is provided in terms of conducted RF power at the antenna connector. If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power limit shall be reduced below the stated value as follows:

- by 1 dB for every 3 dB that the directional gain of antenna exceeds 6 dBi for fixed point-to-point transmitters operate in 2400-2483.5 MHz band;
- without any corresponding reduction for fixed point-to-point transmitters operate in 5725-5850 MHz band;
- by the amount in dB that the directional gain of antenna exceeds 6 dBi for the rest of transmitters.

### 7.8.2 Test procedure

- 7.8.2.1 The EUT was set up as shown in Figure 7.8.1, energized and its proper operation was checked.
- 7.8.2.2 The EUT was adjusted to produce maximum available to end user RF output power.
- 7.8.2.3 The frequency span of spectrum analyzer was set approximately 5 times wider than 20 dB bandwidth of the EUT and the resolution bandwidth was set wider than 20 dB bandwidth of the EUT. To find maximum radiation the turntable was rotated 360° and the measuring antenna height was swept in both vertical and horizontal polarizations.
- 7.8.2.4 The maximum field strength of the EUT carrier frequency was measured as provided in Table 7.8.2 and associated plots.
- 7.8.2.5 The maximum peak output power was calculated from the field strength of carrier as follows:

$$P = (E \times d)^2 / (30 \times G),$$

where P is the peak output power in W, E is the field strength in V/m, d is the test distance and G is the transmitter numeric antenna gain over an isotropic radiator.

The above equation was converted in logarithmic units for 3 m test distance:

$$\text{Peak output power in dBm} = \text{Field strength in dB}(\mu\text{V}/\text{m}) - \text{Transmitter antenna gain in dBi} - 95.2 \text{ dB}$$

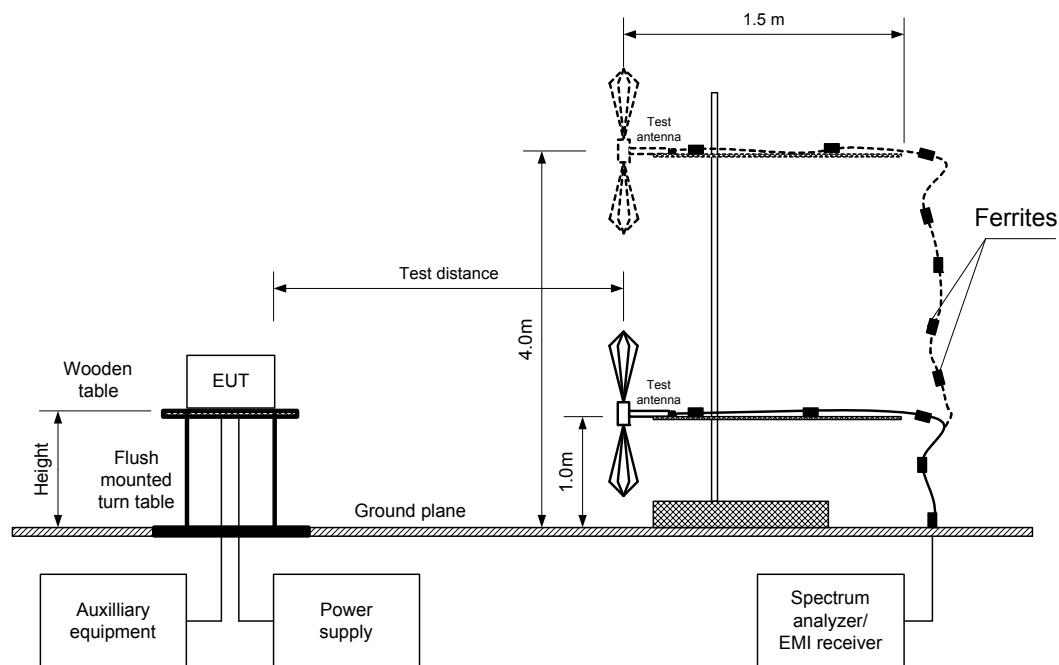
- 7.8.2.6 The worst test results (the lowest margins) were recorded in Table 7.8.2.



HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b), Peak output power	
<b>Test procedure:</b>	ANSI C63.10, section 7.8.5
<b>Test mode:</b>	Compliance
<b>Date(s):</b>	05-Oct-16
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 40 %
	<b>Air Pressure:</b> 1005 hPa
	<b>Power:</b> 120 VAC
<b>Remarks:</b> BLE(GFSK) modulation	

Figure 7.8.1 Setup for carrier field strength measurements





HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b), Peak output power	
<b>Test procedure:</b>	ANSI C63.10, section 7.8.5
<b>Test mode:</b>	Compliance
<b>Date(s):</b>	05-Oct-16
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 40 %
	<b>Air Pressure:</b> 1005 hPa
	<b>Power:</b> 120 VAC
<b>Remarks:</b> BLE(GFSK) modulation	

**Table 7.8.2 Peak output power test results**

ASSIGNED FREQUENCY:	2400-2483.5 MHz
TEST DISTANCE:	3 m
TEST SITE:	Semi anechoic chamber
EUT HEIGHT:	1.5 m
DETECTOR USED:	Peak
TEST ANTENNA TYPE:	Biconilog (30 MHz – 1000 MHz) Double ridged guide (above 1000 MHz)
MODULATION:	BLE(GFSK)
MODULATING SIGNAL:	PRBS
BIT RATE:	0.25 Mbps
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
DETECTOR USED:	Peak
EUT 20 dB BANDWIDTH:	1020 kHz
RESOLUTION BANDWIDTH:	3 MHz
VIDEO BANDWIDTH:	3 MHz
FREQUENCY HOPPING:	Disabled
NUMBER OF FREQUENCY HOPPING CHANNELS:	

Frequency, MHz	Field strength, dB(µV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	EUT antenna gain, dBi	Peak output power, dBm**	Limit, dBm	Margin, dB***	Verdict
2402	109.68	Horizontal	1.7	10	1.72	12.76	30	-17.24	Pass
2441	107.37	Horizontal	1.7	10	1.72	10.45	30	-19.55	Pass
2480	105.49	Horizontal	1.8	20	1.72	8.57	30	-21.43	Pass

\*- EUT front panel refer to 0 degrees position of turntable.

\*\*- Peak output power was calculated from the field strength of carrier as follows:  $P = (E \times d)^2 / (30 \times G)$ , where P is the peak output power in W, E is the field strength in V/m, d is the test distance in meters and G is the transmitter numeric antenna gain over an isotropic radiator. The above equation was converted in logarithmic units for 3 m test distance: Peak output power in dBm = Field strength in dB(µV/m) - Transmitter antenna gain in dBi - 95.2 dB

\*\*\*- Margin = Peak output power – specification limit.

**Reference numbers of test equipment used**

HL 0521	HL 1984	HL 4353	HL 5101				
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Full description is given in Appendix A.

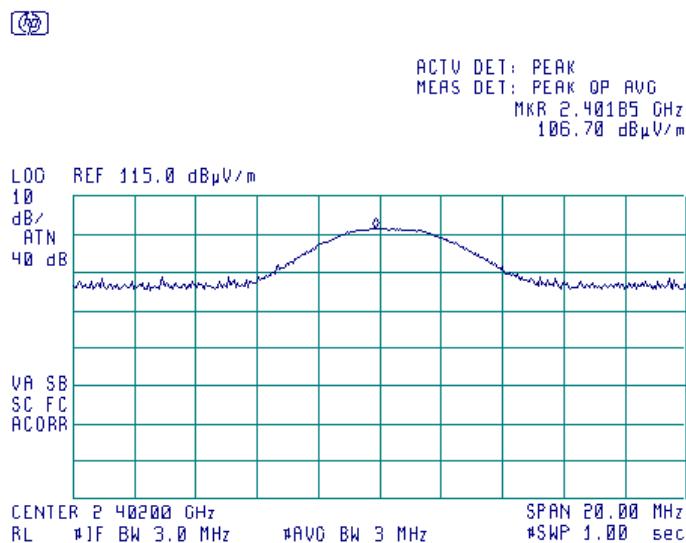


HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b), Peak output power	
<b>Test procedure:</b>	ANSI C63.10, section 7.8.5
<b>Test mode:</b>	Compliance
<b>Date(s):</b>	05-Oct-16
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 40 %
	<b>Air Pressure:</b> 1005 hPa
	<b>Power:</b> 120 VAC
<b>Remarks:</b> BLE(GFSK) modulation	

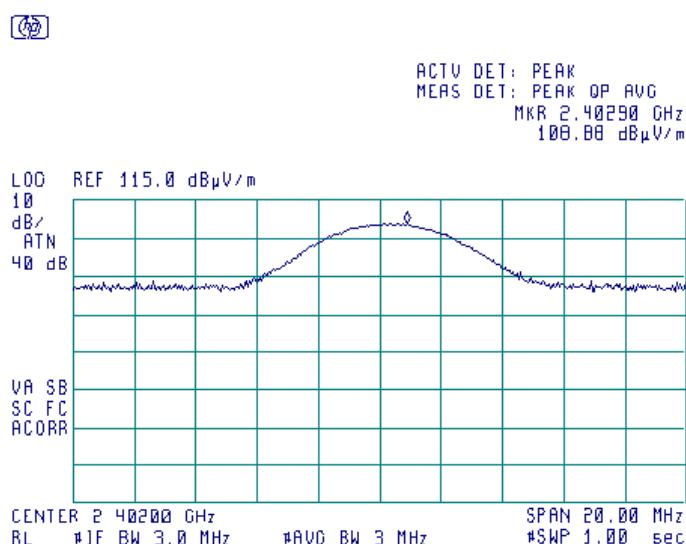
**Plot 7.8.1 Field strength of carrier at low frequency vertical antenna polarization**

EUT POSITION: X-axis



**Plot 7.8.2 Field strength of carrier at low frequency vertical antenna polarization**

EUT POSITION: Y-axis



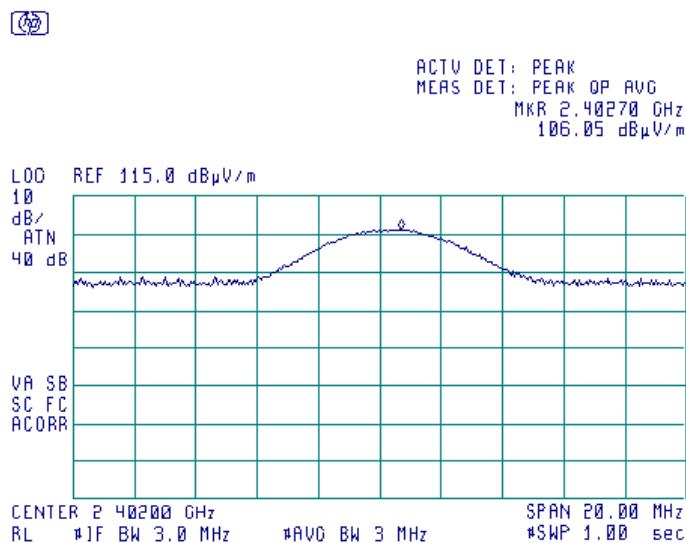


HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b), Peak output power	
<b>Test procedure:</b>	ANSI C63.10, section 7.8.5
<b>Test mode:</b>	Compliance
<b>Date(s):</b>	05-Oct-16
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 40 %
	<b>Air Pressure:</b> 1005 hPa
	<b>Power:</b> 120 VAC
<b>Remarks:</b> BLE(GFSK) modulation	

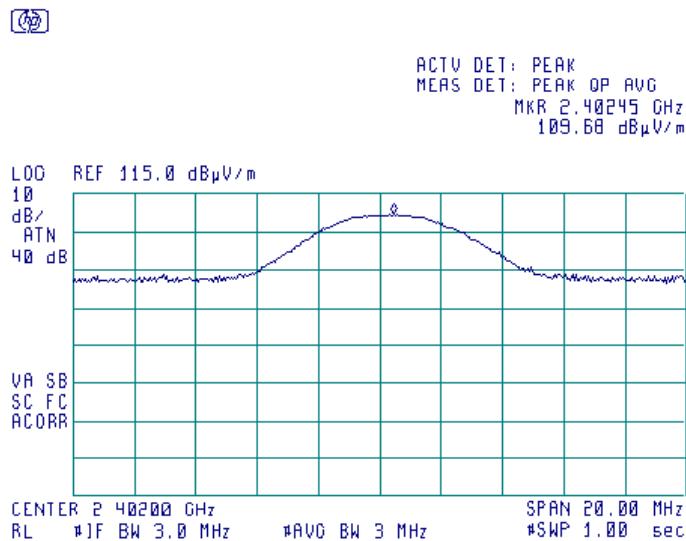
**Plot 7.8.3 Field strength of carrier at low frequency vertical antenna polarization**

EUT POSITION: Z-axis



**Plot 7.8.4 Field strength of carrier at low frequency horizontal antenna polarization**

EUT POSITION: X-axis



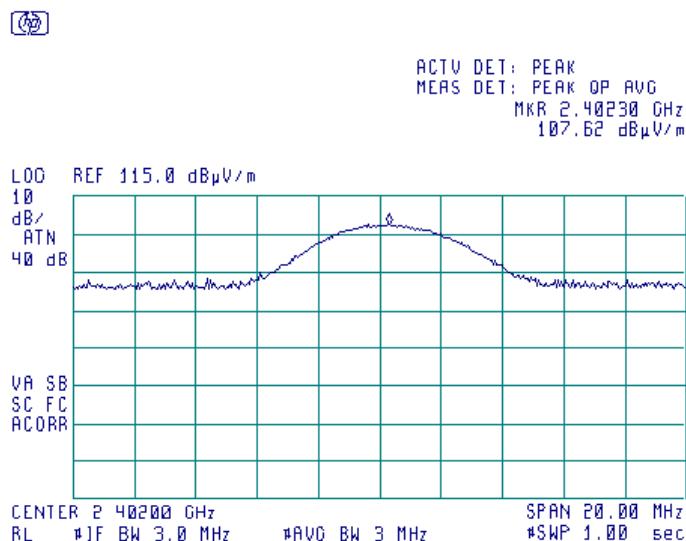


HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b), Peak output power	
<b>Test procedure:</b>	ANSI C63.10, section 7.8.5
<b>Test mode:</b>	Compliance
<b>Date(s):</b>	05-Oct-16
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 40 %
	<b>Air Pressure:</b> 1005 hPa
	<b>Power:</b> 120 VAC
<b>Remarks:</b> BLE(GFSK) modulation	

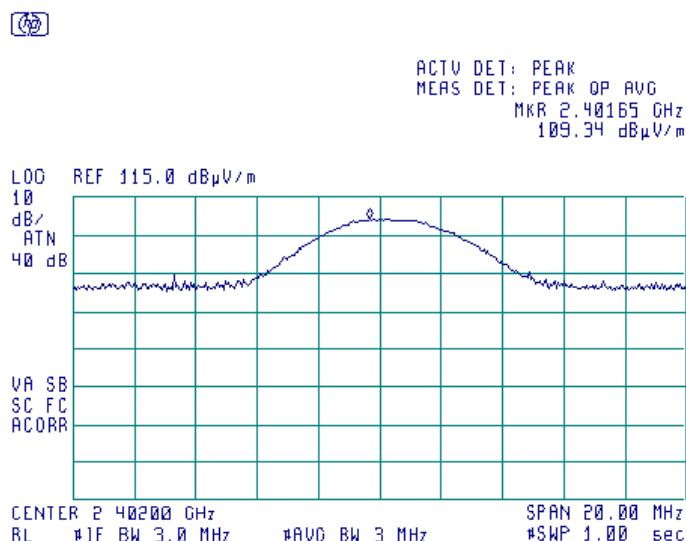
**Plot 7.8.5 Field strength of carrier at low frequency horizontal antenna polarization**

EUT POSITION: Y-axis



**Plot 7.8.6 Field strength of carrier at low frequency horizontal antenna polarization**

EUT POSITION: Z-axis



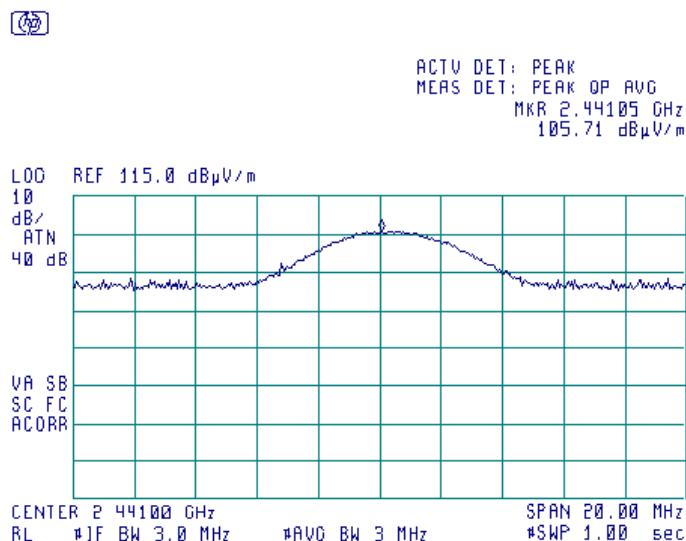


HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b), Peak output power	
<b>Test procedure:</b>	ANSI C63.10, section 7.8.5
<b>Test mode:</b>	Compliance
<b>Date(s):</b>	05-Oct-16
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 40 %
	<b>Air Pressure:</b> 1005 hPa
	<b>Power:</b> 120 VAC
<b>Remarks:</b> BLE(GFSK) modulation	

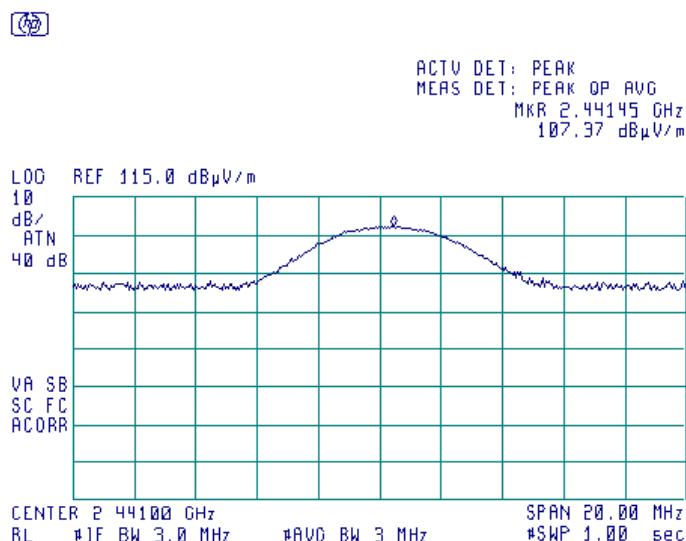
**Plot 7.8.7 Field strength of carrier at mid frequency vertical antenna polarization**

EUT POSITION: X-axis



**Plot 7.8.8 Field strength of carrier at mid frequency vertical antenna polarization**

EUT POSITION: Y-axis



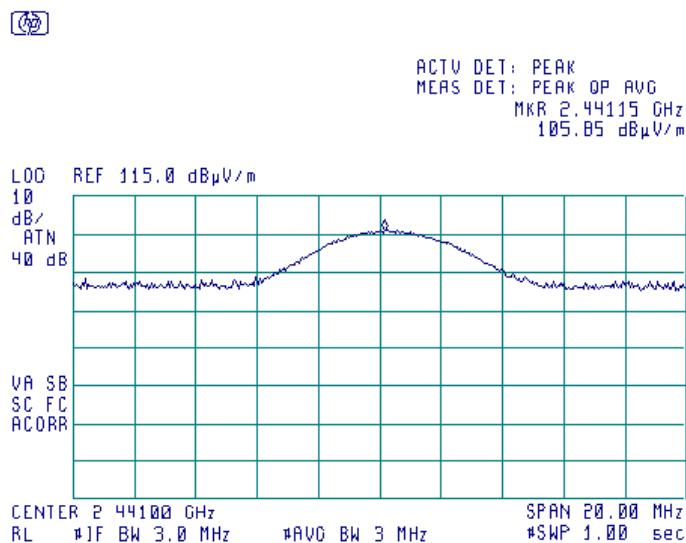


HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b), Peak output power	
<b>Test procedure:</b>	ANSI C63.10, section 7.8.5
<b>Test mode:</b>	Compliance
<b>Date(s):</b>	05-Oct-16
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 40 %
	<b>Air Pressure:</b> 1005 hPa
	<b>Power:</b> 120 VAC
<b>Remarks:</b> BLE(GFSK) modulation	

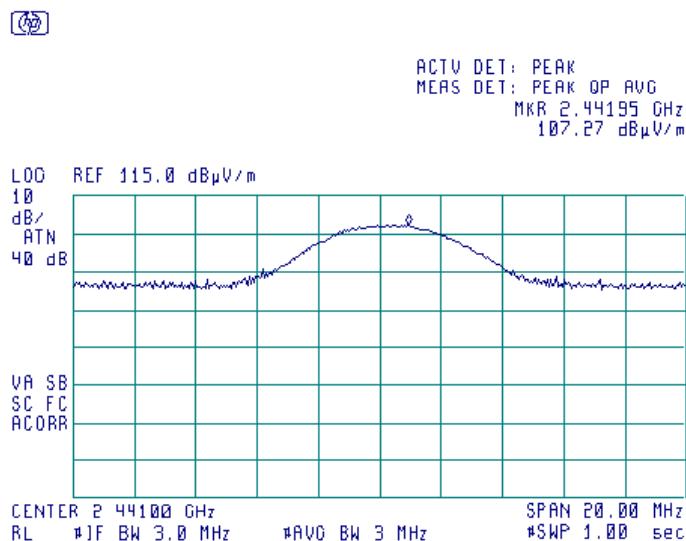
**Plot 7.8.9 Field strength of carrier at mid frequency vertical antenna polarization**

EUT POSITION: Z-axis



**Plot 7.8.10 Field strength of carrier at mid frequency horizontal antenna polarization**

EUT POSITION: X-axis



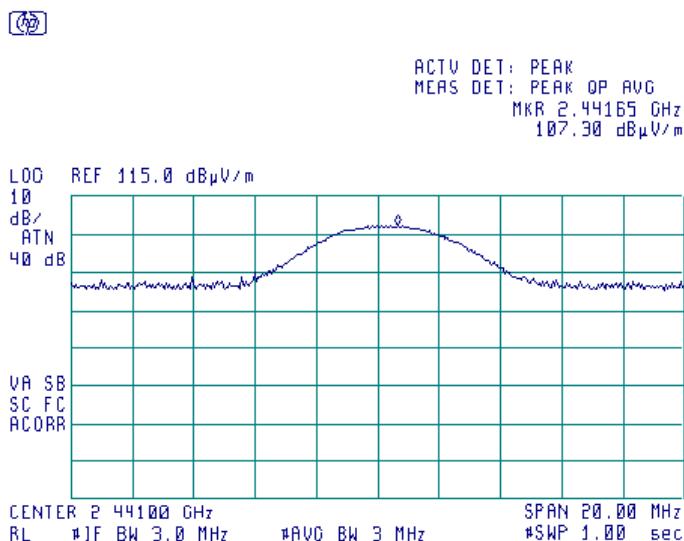


HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b), Peak output power	
<b>Test procedure:</b>	ANSI C63.10, section 7.8.5
<b>Test mode:</b>	Compliance
<b>Date(s):</b>	05-Oct-16
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 40 %
	<b>Air Pressure:</b> 1005 hPa
	<b>Power:</b> 120 VAC
<b>Remarks:</b> BLE(GFSK) modulation	

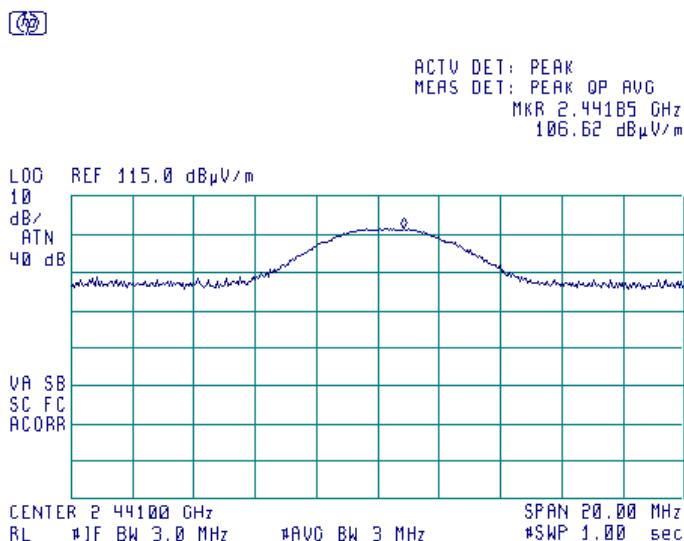
**Plot 7.8.11 Field strength of carrier at mid frequency horizontal antenna polarization**

EUT POSITION: Y-axis



**Plot 7.8.12 Field strength of carrier at mid frequency horizontal antenna polarization**

EUT POSITION: Z-axis



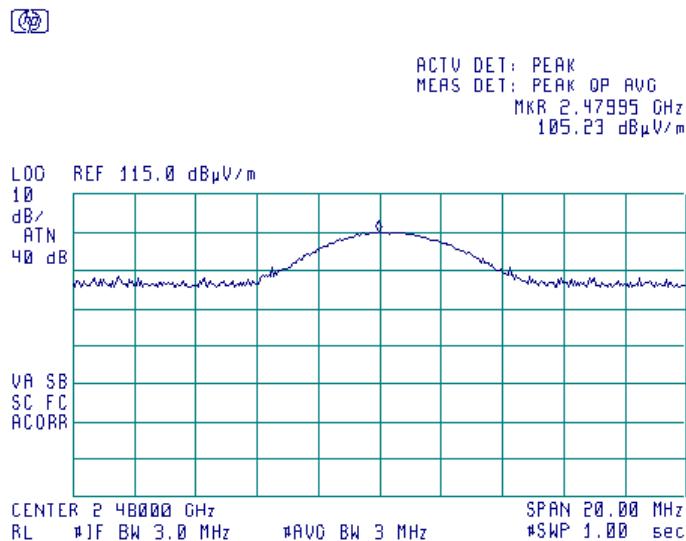


HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b), Peak output power	
<b>Test procedure:</b>	ANSI C63.10, section 7.8.5
<b>Test mode:</b>	Compliance
<b>Date(s):</b>	05-Oct-16
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 40 %
	<b>Air Pressure:</b> 1005 hPa
	<b>Power:</b> 120 VAC
<b>Remarks:</b> BLE(GFSK) modulation	

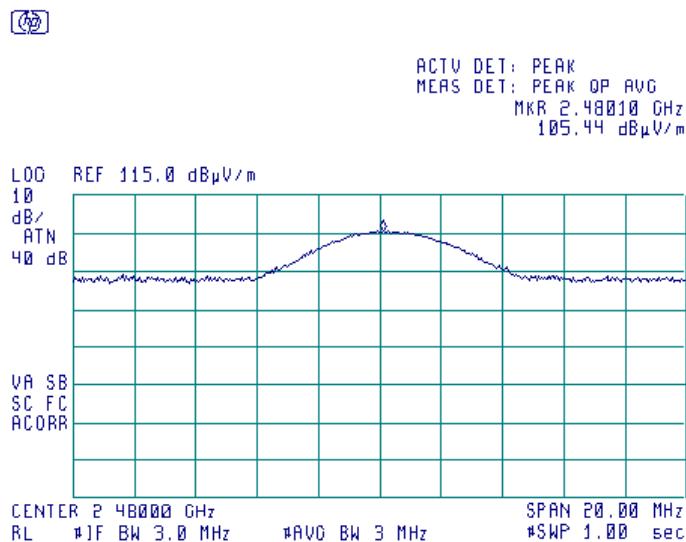
**Plot 7.8.13 Field strength of carrier at high frequency vertical antenna polarization**

EUT POSITION: X-axis



**Plot 7.8.14 Field strength of carrier at high frequency vertical antenna polarization**

EUT POSITION: Y-axis



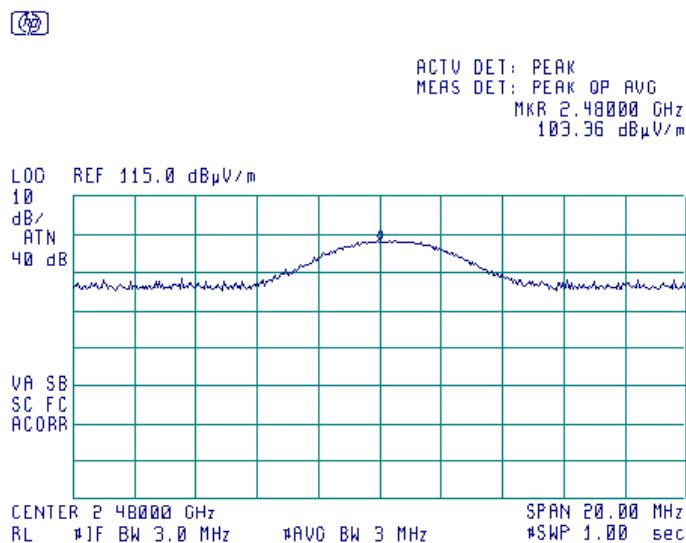


HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b), Peak output power	
<b>Test procedure:</b>	ANSI C63.10, section 7.8.5
<b>Test mode:</b>	Compliance
<b>Date(s):</b>	05-Oct-16
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 40 %
	<b>Air Pressure:</b> 1005 hPa
	<b>Power:</b> 120 VAC
<b>Remarks:</b> BLE(GFSK) modulation	

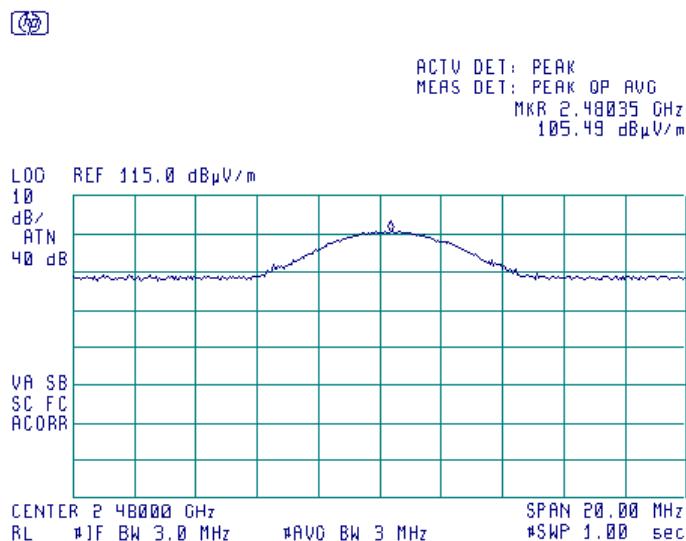
**Plot 7.8.15 Field strength of carrier at high frequency vertical antenna polarization**

EUT POSITION: Z-axis



**Plot 7.8.16 Field strength of carrier at high frequency horizontal antenna polarization**

EUT POSITION: X-axis



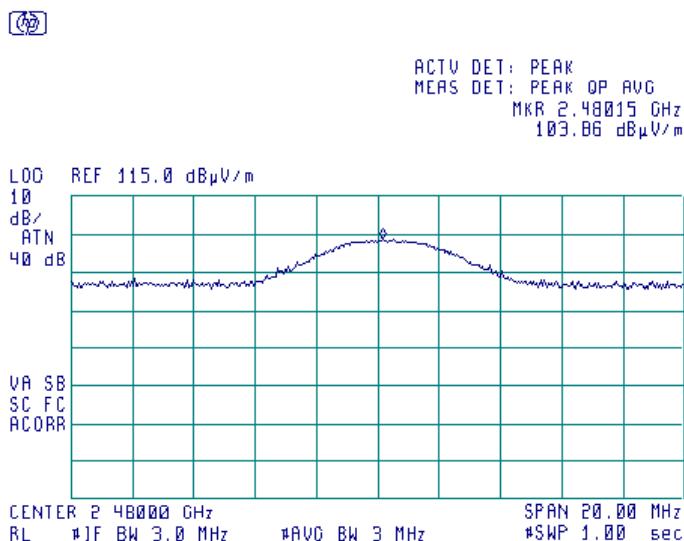


HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(b), Peak output power	
<b>Test procedure:</b>	ANSI C63.10, section 7.8.5
<b>Test mode:</b>	Compliance
<b>Date(s):</b>	05-Oct-16
<b>Temperature:</b> 24 °C	<b>Relative Humidity:</b> 40 %
	<b>Air Pressure:</b> 1005 hPa
	<b>Power:</b> 120 VAC
<b>Remarks:</b> BLE(GFSK) modulation	

**Plot 7.8.17 Field strength of carrier at high frequency horizontal antenna polarization**

EUT POSITION: Y-axis



**Plot 7.8.18 Field strength of carrier at high frequency horizontal antenna polarization**

EUT POSITION: Z-axis

