839.01
Electrical

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TEST REPORT

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

FOR:

Telematics Wireless Ltd.

Water meter

Model: Universal 2

Table of contents

1 Applicant information

Client name:	Telematics Wireless Ltd.
Address:	26 Hamelaha street, POB 1911, Holon, 58117, Israel
Telephone:	+972 3557 5767
Fax:	+972 3557 5753
E-mail:	slavas@tlmw.com
Contact name:	Mr. Slava Snitkovsky

2 Equipment under test attributes

Product name:	Water meter
Product type:	Transceiver
Model(s):	Universal 2
Serial number:	WMT100 00001889
Hardware version:	A
Receipt date	6/29/2010

3 Manufacturer information

Manufacturer name:	Telematics Wireless Ltd.
Address:	26 Hamelaha street, POB 1911, Holon, 58117, Israel
Telephone:	+972 3557 5767
Fax:	+972 3557 5753
E-Mail:	slavas@tlmw.com
Contact name:	Mr. Slava Snitkovsky

4 Test details

Project ID:	20960
Location:	Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started:	6/29/2010
Test completed:	7/18/2010
Test specification(s):	FCC 47CFR part 15:2009, subpart C §15.247; subpart B §15.109

5 Tests summary

Test	Status
Transmitter characteristics	
FCC Section 15.247(a)2, 6 dB bandwidth	Pass
FCC Section 15.247(b)3, Peak output power	Pass
FCC section 15.247(i), RF exposure	Pass, the exhibit to the application of certification is provided
FCC Section 15.247(c), Radiated spurious emissions	Pass
FCC Section 15.247(e), Peak power density	Pass
FCC FCC section 15.203, Antenna requirement	Pass
Section 15.207(a), Conducted emission	Not required
Unintentional emissions	
FCC 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
Tested by:	Mr. L. Markel, test engineer	July 18, 2010	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	July 22, 2010	
Approved by:	Mr. M. Nikishin, EMC and Radio group manager	August 16, 2010	

6 EUT description

6.1 General information

The EUT, Universal 2, is a 2-Way RF unit which is connected to an existing Meter/Register via wires.
The RF capabilities enable the transmission of the meter reading and some extra information to a remote collecting unit. In addition specific parameters can be programmed via the RF link. The EUT is powered from two 3.6 VDC lithium internal batteries. The tests were performed with the EUT using new batteries.

6.2 Support and test equipment

Description	Manufacturer	Model number	Serial number
PC Laptop	Dell	D620	HX8VV2J
Command transceiver	Telematics Wireless	NA	NA

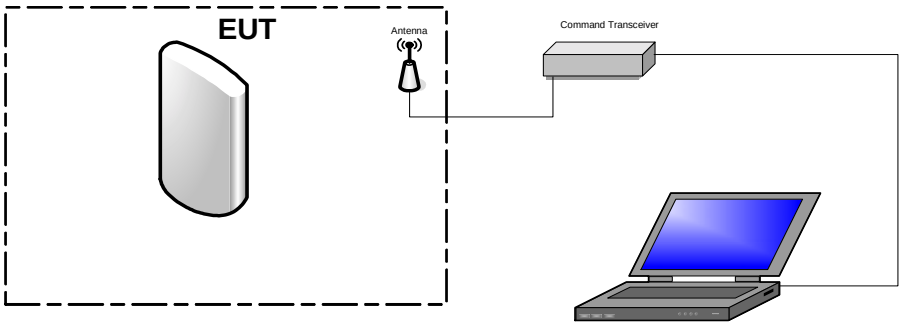
6.3 Operating frequencies

Source	Frequency, MHz
Tx	905.43 - 923.55 MHz
Stand-by mode	14.487

6.4 Changes made in the EUT

No changes were implemented in the EUT.

6.5 Test configuration



6.6 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
X	mobile	Always at a distance more than 20 cm from all people
	portable	May operate at a distance closer than 20 cm to human body

Assigned frequency range	902-928 MHz
Operating frequency range	905.43 - 923.55 MHz
RF channel spacing	3.62 MHz

Maximum rated output power		
	At transmitter 50 Ω RF output connector	NA
	Peak output power	16.50 dBm (FSK) 19.27 dBm (PSK)

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
Integral	Telematics Wireless Ltd.	Printed inverted F antenna	1.5 dBi

Transmitter aggregate data rate/s	60 kbps				
Transmitter aggregate symbol (baud) rate/s	0.9 Msymbols (MBaud) per second (FSK modulated)				
Type of modulation	FSK, PSK				
Modulating test signal (baseband)	PRBS				
Maximum transmitter duty cycle in normal use	1%				
Transmitter duty cycle supplied for test	0.007% 0.012%	**Tx ON time PSK:** **Tx ON time FSK**	2.875 ms 5.100 ms	**Period:** **Period:**	422.5 ms 421.5 ms

Transmitter power source							
X	Battery	**Nominal rated voltage**	3.6VDC	Battery type	Lithium		
	DC	**Nominal rated voltage**	VDC				
	AC mains	**Nominal rated voltage**	VAC	Frequency	Hz		

Common power source for transmitter and receiver	X	yes		no

Spread spectrum parameters for transmitters tested per FCC 15.247 only		
DSSS	Chip sequence length	15 bits
	Spectrum width	2 MHz

Test specification:	Section 15.247(a)2, 6 dB bandwidth		
Test procedure:	FR Vol.62, page 26243, Section 15.247(a)2		
Test mode:	Compliance	Verdict:	PASS
Date:	6/29/2010		
Temperature: 24.2 ºC	Air Pressure: 1006 hPa	Relative Humidity: 46 %	Power Supply: 3.6 V battery
Remarks:			

7 Transmitter tests according to 47CFR part 15 subpart C requirements

7.1 Minimum 6 dB bandwidth

7.1.1 General

This test was performed to measure 6 dB bandwidth of the EUT carrier frequency. Specification test limits are given in Table 7.1.1.

Table 7.1.1 The 6 dB bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, dBc	Minimum bandwidth, kHz
902.0 – 928.0	6.0	500.0

* - Modulation envelope reference points provided in terms of attenuation below the peak of modulated carrier.

7.1.2 Test procedure

7.1.2.1 The EUT was set up as shown in Figure 7.1.1, energized and its proper operation was checked.
7.1.2.2 The EUT was set to transmit modulated carrier.
7.1.2.3 The transmitter minimum 6 dB bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.1.2 and associated plot.

Figure 7.1.1 The 6 dB bandwidth test setup

Test specification:	Section 15.247(a)2, 6 dB bandwidth		
Test procedure:	FR Vol.62, page 26243, Section 15.247(a)2		
Test mode:	Compliance	Verdict:	PASS
Date:	6/29/2010		
Temperature: 24.2 ºC	Air Pressure: 1006 hPa	Relative Humidity: 46 %	Power Supply: 3.6 V battery
Remarks:			

Table 7.1.2 The 6 dB bandwidth test results

ASSIGNED FREQUENCY BAND: 902.0 – 928.0 MHz
DETECTOR USED: Peak
SWEEP MODE: Max Hold
SWEEP TIME: Auto
RESOLUTION BANDWIDTH: 100 kHz
VIDEO BANDWIDTH: 300 kHz
MODULATION ENVELOPE REFERENCE POINTS: 6.0 dBc
MODULATING SIGNAL: PRBS
BIT RATE: 60 kbps

Carrier frequency, MHz	6 dB bandwidth, kHz	Limit, kHz	Margin, kHz	Verdict
PSK modulation				
905.43	963.0	500.0	-463.0	Pass
914.50	963.0	500.0	-463.0	Pass
923.55	950.0	500.0	-450.0	Pass
FSK modulation				
905.43	520.0	500.0	-20.0	Pass
914.50	523.0	500.0	-23.0	Pass
923.55	525.0	500.0	-25.0	Pass

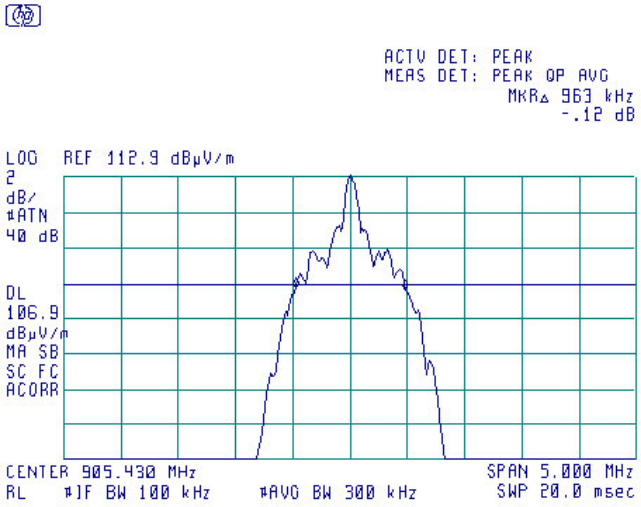
Reference numbers of test equipment used

HL 0521	HL 0604	HL 2871	HL 3616					

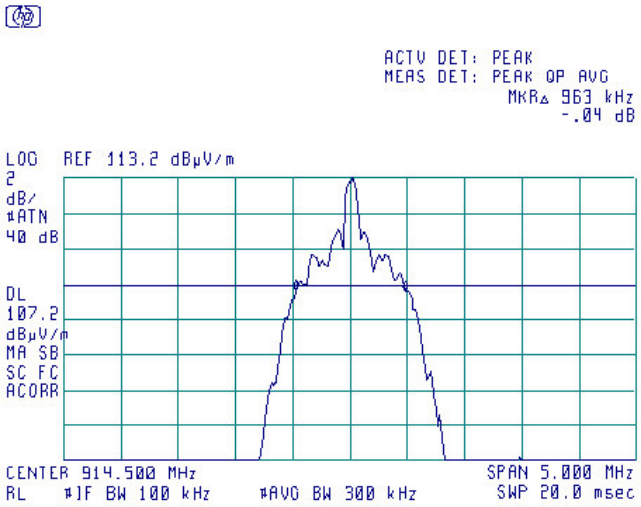
Full description is given in Appendix A.

Test specification:	Section 15.247(a)2, 6 dB bandwidth		
Test procedure:	FR Vol.62, page 26243, Section 15.247(a)2		
Test mode:	Compliance	Verdict:	PASS
Date:	6/29/2010		
Temperature: 24.2 ºC	Air Pressure: 1006 hPa	Relative Humidity: 46 %	Power Supply: 3.6 V battery
Remarks:			

Plot 7.1.1 The 6 dB bandwidth test result at low frequency PSK

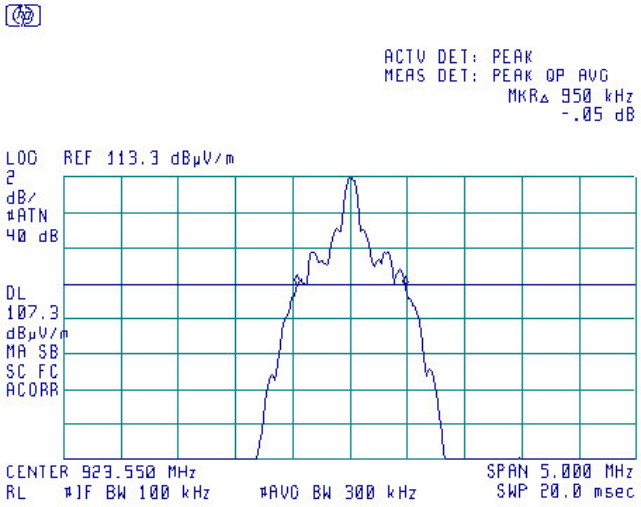


Plot 7.1.2 The 6 dB bandwidth test result at mid frequency PSK



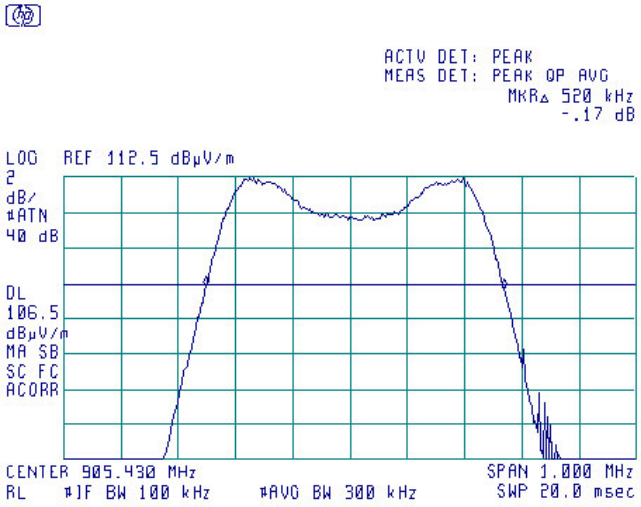
Test specification:	Section 15.247(a)2, 6 dB bandwidth		
Test procedure:	FR Vol.62, page 26243, Section 15.247(a)2		
Test mode:	Compliance	Verdict:	PASS
Date:	6/29/2010		
Temperature: 24.2 ºC	Air Pressure: 1006 hPa	Relative Humidity: 46 %	Power Supply: 3.6 V battery
Remarks:			

Plot 7.1.3 The 6 dB bandwidth test result at high frequency PSK

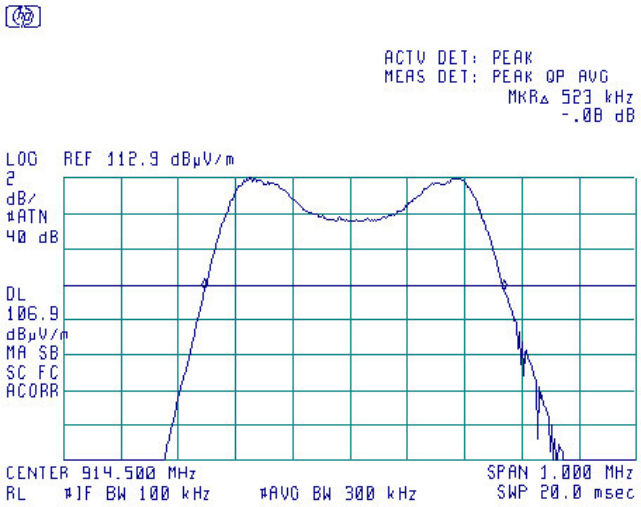


Test specification:	Section 15.247(a)2, 6 dB bandwidth		
Test procedure:	FR Vol.62, page 26243, Section 15.247(a)2		
Test mode:	Compliance	Verdict:	PASS
Date:	6/29/2010		
Temperature: 24.2 ºC	Air Pressure: 1006 hPa	Relative Humidity: 46 %	Power Supply: 3.6 V battery
Remarks:			

Plot 7.1.4 The 6 dB bandwidth test result at low frequency FSK

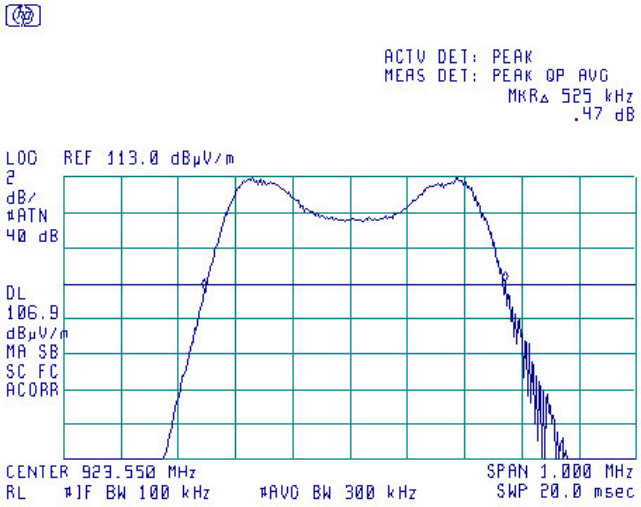


Plot 7.1.5 The 6 dB bandwidth test result at mid frequency FSK



Test specification:	Section 15.247(a)2, 6 dB bandwidth		
Test procedure:	FR Vol.62, page 26243, Section 15.247(a)2		
Test mode:	Compliance	Verdict:	PASS
Date:	6/29/2010		
Temperature: 24.2 ºC	Air Pressure: 1006 hPa	Relative Humidity: 46 %	Power Supply: 3.6 V battery
Remarks:			

Plot 7.1.6 The 6 dB bandwidth test result at high frequency FSK



Test specification:	Section 15.247(b)3, Peak output power		
Test procedure:	FR Vol.62, page 26243, Section 15.247(b)		
Test mode:	Compliance	Verdict:	PASS
Date:	6/29/2010		
Temperature: 24.2 ºC	Air Pressure: 1006 hPa	Relative Humidity: 46 %	Power Supply: 3.6 V battery
Remarks:			

7.2 Peak output power

7.2.1 General

This test was performed to measure the maximum peak output power radiated by transmitter. Specification test limits are given in Table 7.2.1.

Table 7.2.1 Peak output power limits

Assigned frequency range, MHz	Maximum antenna gain, dBi	Peak output power*		Equivalent field strength limit @ 3m, dB(μV/m)**
		W	dBm	
902.0 – 928.0	6.0	1.0	30.0	131.2

*- 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.

**- Equivalent field strength limit was calculated from the peak output power as follows: E=sqrt(30×P×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.

7.2.2 Test procedure

7.2.2.1 The EUT was set up as shown in Figure 7.2.1, energized and its proper operation was checked.

7.2.2.2 The EUT was adjusted to produce maximum available to end user RF output power.

7.2.2.3 The resolution bandwidth of spectrum analyzer was set wider than 6 dB bandwidth of the EUT and the field strength of the EUT carrier frequency was measured with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360^0 and the measuring antenna height was swept in both vertical and horizontal polarizations.

7.2.2.4 The maximum field strength of the EUT carrier frequency was measured as provided in Table 7.2.2 and associated plots.

7.2.2.5 The maximum peak output power was calculated from the field strength of carrier as follows:

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

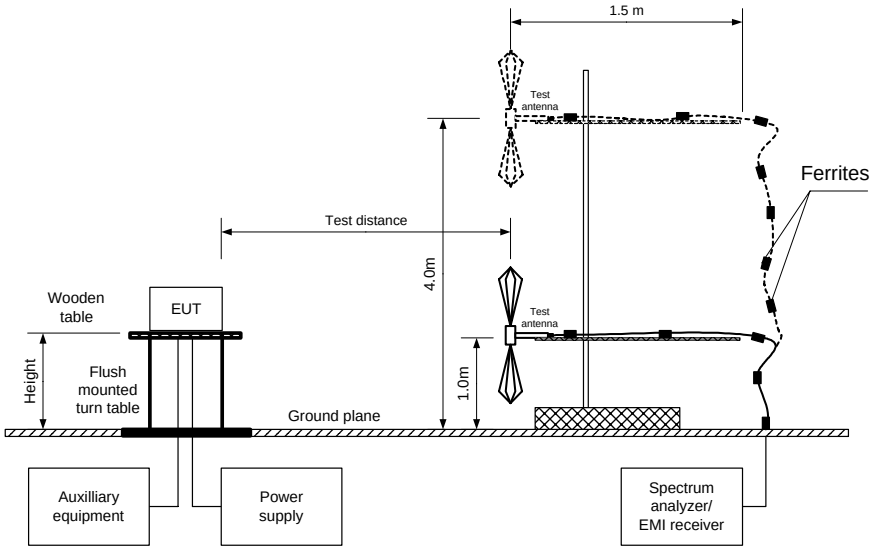
where P is the peak output power in W, E is the field strength in V/m, d is the test distance and G is the transmitter numeric antenna gain over an isotropic radiator.
The above equation was converted in logarithmic units for 3 m test distance:

Peak output power in dBm = Field strength in dB(μV/m) - Transmitter antenna gain in dBi – 95.2 dB

7.2.2.6 The worst test results (the lowest margins) were recorded in Table 7.2.2.

Test specification:	Section 15.247(b)3, Peak output power		
Test procedure:	FR Vol.62, page 26243, Section 15.247(b)		
Test mode:	Compliance	Verdict:	PASS
Date:	6/29/2010		
Temperature: 24.2 ºC	Air Pressure: 1006 hPa	Relative Humidity: 46 %	Power Supply: 3.6 V battery
Remarks:			

Figure 7.2.1 Setup for carrier field strength measurements



Test specification:	**Section 15.247(b)3, Peak output power**		
Test procedure:	FR Vol.62, page 26243, Section 15.247(b)		
Test mode:	Compliance	**Verdict:**	PASS
Date:	6/29/2010		
Temperature: 24.2 ºC	**Air Pressure:** 1006 hPa	**Relative Humidity:** 46 %	**Power Supply:** 3.6 V battery
Remarks:			

Table 7.2.2 Peak output power test results

ASSIGNED FREQUENCY BAND: 902.0 – 928.0 MHz
TEST DISTANCE: 3 m
TEST SITE: Semi anechoic chamber
EUT HEIGHT: 0.8 m
DETECTOR USED: Peak
TEST ANTENNA TYPE: Biconilog (30 MHz – 1000 MHz)
MODULATING SIGNAL: PRBS
BIT RATE: 60 kbps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
DETECTOR USED: Peak
EUT 6 dB BANDWIDTH: 963.0 kHz (PSK) / 525.0 kHz (FSK)
RESOLUTION BANDWIDTH: 1000 kHz
VIDEO BANDWIDTH: 3000 kHz

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
PSK modulation									
905.43	115.34	V	1.1	350	1.5	18.61	30.00	-11.39	Pass
914.50	115.40	V	1.1	350	1.5	18.67	30.00	-11.33	Pass
923.55	116.00	V	1.1	350	1.5	19.27	30.00	-10.73	Pass
FSK modulation									
905.43	112.76	V	1.1	350	1.5	16.03	30.00	-13.97	Pass
914.50	113.21	V	1.1	350	1.5	16.48	30.00	-13.52	Pass
923.55	113.23	V	1.1	350	1.5	16.50	30.00	-13.50	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.

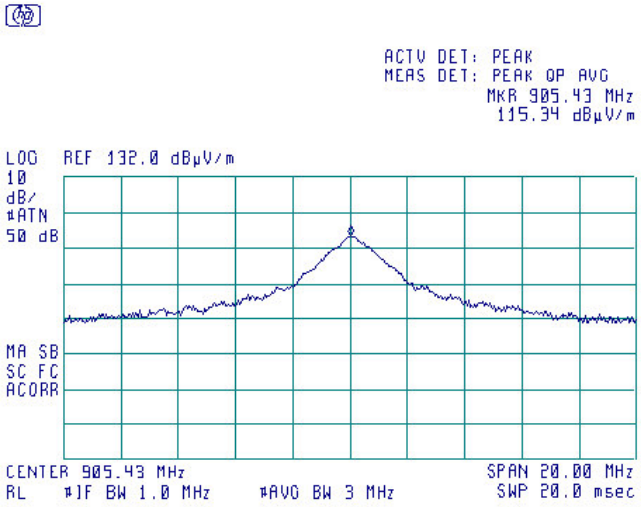
Reference numbers of test equipment used

HL 0521	HL 0604	HL 2871	HL 3616				

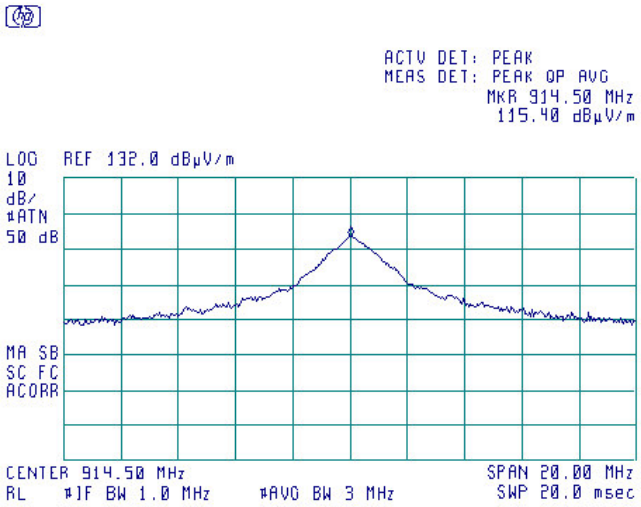
Full description is given in Appendix A.

Test specification:	Section 15.247(b)3, Peak output power		
Test procedure:	FR Vol.62, page 26243, Section 15.247(b)		
Test mode:	Compliance	Verdict:	PASS
Date:	6/29/2010		
Temperature: 24.2 ºC	Air Pressure: 1006 hPa	Relative Humidity: 46 %	Power Supply: 3.6 V battery
Remarks:			

Plot 7.2.1 Field strength of carrier at low frequency, PSK modulation

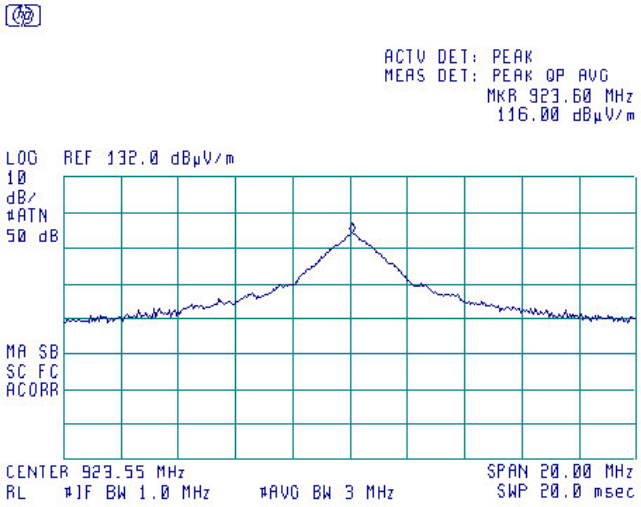


Plot 7.2.2 Field strength of carrier at mid frequency, PSK modulation



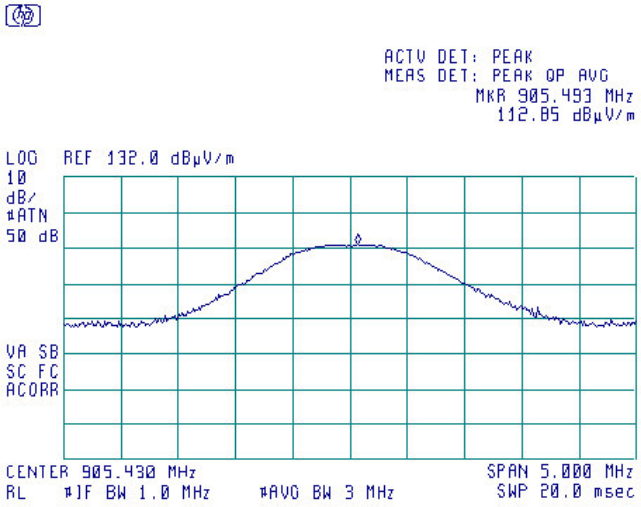
Test specification:	Section 15.247(b)3, Peak output power		
Test procedure:	FR Vol.62, page 26243, Section 15.247(b)		
Test mode:	Compliance	Verdict:	PASS
Date:	6/29/2010		
Temperature: 24.2 ºC	Air Pressure: 1006 hPa	Relative Humidity: 46 %	Power Supply: 3.6 V battery
Remarks:			

Plot 7.2.3 Field strength of carrier at high frequency, PSK modulation

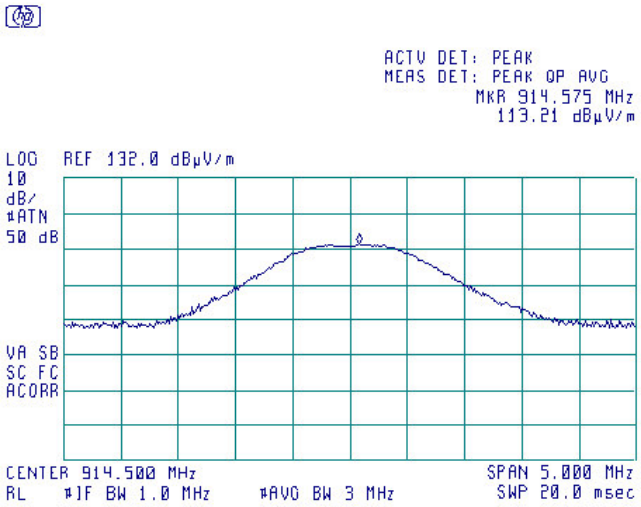


Test specification:	Section 15.247(b)3, Peak output power		
Test procedure:	FR Vol.62, page 26243, Section 15.247(b)		
Test mode:	Compliance	Verdict:	PASS
Date:	6/29/2010		
Temperature: 24.2 ºC	Air Pressure: 1006 hPa	Relative Humidity: 46 %	Power Supply: 3.6 V battery
Remarks:			

Plot 7.2.4 Field strength of carrier at low frequency modulation

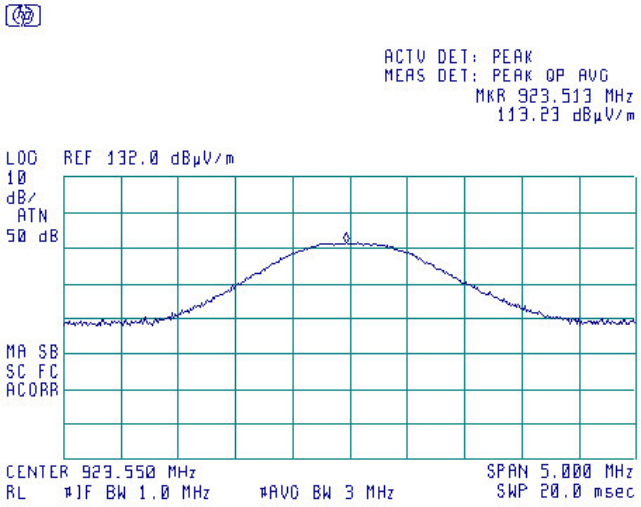


Plot 7.2.5 Field strength of carrier at mid frequency, FSK modulation



Test specification:	Section 15.247(b)3, Peak output power		
Test procedure:	FR Vol.62, page 26243, Section 15.247(b)		
Test mode:	Compliance	Verdict:	PASS
Date:	6/29/2010		
Temperature: 24.2 ºC	Air Pressure: 1006 hPa	Relative Humidity: 46 %	Power Supply: 3.6 V battery
Remarks:			

Plot 7.2.6 Field strength of carrier at high frequency, FSK modulation



Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	6/29/2010		
Temperature: 24.6 ºC	Air Pressure: 1006 hPa	Relative Humidity: 46 %	Power Supply: 3.6 V battery
Remarks:			

7.3 Field strength of spurious emissions

7.3.1 General

This test was performed to measure field strength of spurious emissions from the EUT. Specification test limits are given in Table 7.3.1.

Table 7.3.1 Radiated spurious emissions limits

Frequency, MHz	Field strength at 3 m within restricted bands, dB(µV/m)*			Attenuation of field strength of spurious versus carrier outside restricted bands, dBc***
	Peak	Quasi Peak	Average	
0.009 – 0.090	148.5 – 128.5	NA	128.5 – 108.5**	20.0
0.090 – 0.110	NA	108.5 – 106.8**	NA	
0.110 – 0.490	126.8 – 113.8	NA	106.8 – 93.8**	
0.490 – 1.705	NA	73.8 – 63.0**	NA	
1.705 – 30.0*		69.5		
30 – 88		40.0		
88 – 216		43.5		
216 – 960		46.0		
960 - 1000		54.0		
1000 – 10th harmonic	74.0	NA	54.0	

*- The limit for 3 m test distance was calculated using the inverse square distance extrapolation factor as follows:

$$Lim_{S2} = Lim_{S1} + 40 \log (S_1/S_2),$$

where S_1 and S_2 – standard defined and test distance respectively in meters.

**- The limit decreases linearly with the logarithm of frequency.

*** - The field strength limits applied from the lowest radio frequency generated in the device, without going below 9 kHz up to the tenth harmonic of the highest fundamental frequency.

7.3.2 Test procedure for spurious emission field strength measurements in 9 kHz to 30 MHz band

7.3.2.1 The EUT was set up as shown in Figure 7.3.1, energized and the performance check was conducted.

7.3.2.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360^0 and the measuring antenna was rotated around its vertical axis.

7.3.2.3 The worst test results (the lowest margins) were recorded and shown in the associated plots.

7.3.3 Test procedure for spurious emission field strength measurements above 30 MHz

7.3.3.1 The EUT was set up as shown in Figure 7.3.2, energized and the performance check was conducted.

7.3.3.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360^0, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal.

7.3.3.3 The worst test results (the lowest margins) were recorded and shown in the associated plots.

Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	6/29/2010		
Temperature: 24.6 ºC	Air Pressure: 1006 hPa	Relative Humidity: 46 %	Power Supply: 3.6 V battery
Remarks:			

Figure 7.3.1 Setup for spurious emission field strength measurements below 30 MHz

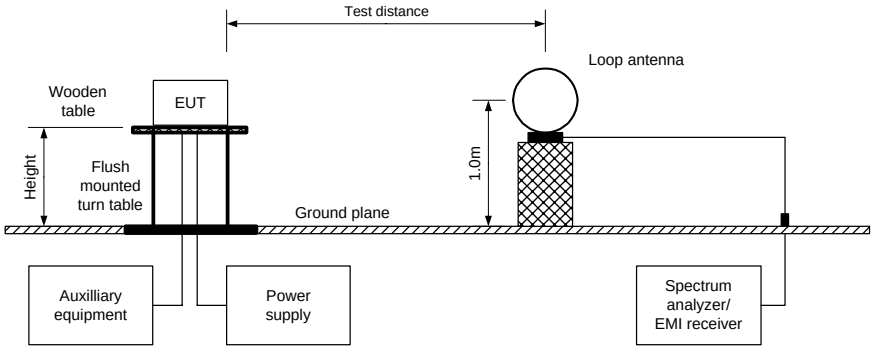
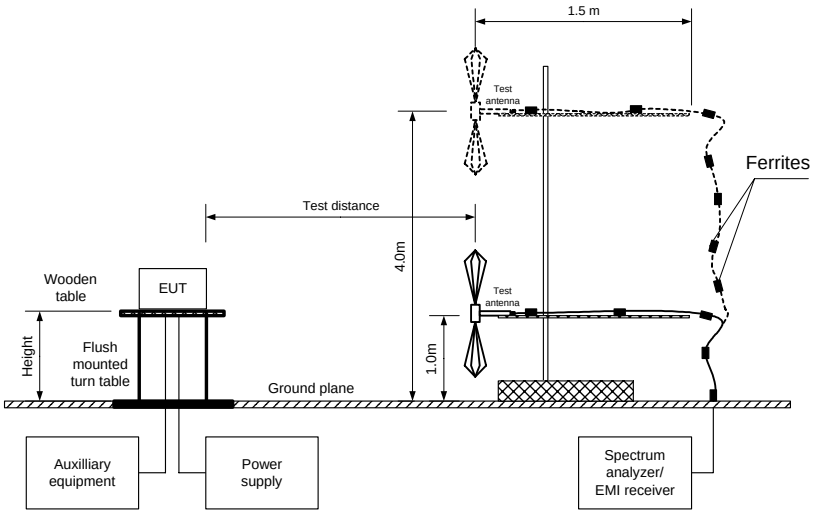


Figure 7.3.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:	**Section 15.247(c), Radiated spurious emissions**		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date:	6/29/2010		
Temperature: 24.6 ºC	**Air Pressure:** 1006 hPa	**Relative Humidity:** 46 %	**Power Supply:** 3.6 V battery
Remarks:			

Table 7.3.2 Field strength of emissions outside restricted bands

ASSIGNED FREQUENCY BAND:	902.0 – 928.0 MHz
INVESTIGATED FREQUENCY RANGE:	0.009 - 10000 MHz
TEST DISTANCE:	3 m
MODULATION:	PSK (worst case results)
MODULATING SIGNAL:	PRBS
BIT RATE:	60 kbps
DUTY CYCLE:	0.007 %
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
DETECTOR USED:	Peak
RESOLUTION BANDWIDTH:	100 kHz
VIDEO BANDWIDTH:	300 kHz
TEST ANTENNA TYPE:	Active loop (9 kHz – 30 MHz) Biconilog (30 MHz – 1000 MHz) Double ridged guide (above 1000 MHz)

Frequency MHz	Field strength of spurious, dB(µV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	Field strength of carrier, dB(µV/m)	Attenuation below carrier, dBc	Limit, dBc	Margin, dB**	Verdict
Low carrier frequency									
1810.853	57.14	H	1.35	320	112.92	55.78	20.0	-35.78	Pass
7243.445	52.50	H	1.40	330		60.42		-40.42	
Mid carrier frequency									
1828.998	58.20	H	1.35	320	113.24	55.04	20.0	-35.04	Pass
High carrier frequency									
1847.095	57.87	H	1.35	320	113.34	55.47	20.0	-35.47	Pass

*****- EUT front panel refers to 0 degrees position of turntable.
******- Margin = Attenuation below carrier – specification limit.

Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	6/29/2010		
Temperature: 24.6 ºC	Air Pressure: 1006 hPa	Relative Humidity: 46 %	Power Supply: 3.6 V battery
Remarks:			

Table 7.3.3 Field strength of spurious emissions above 1 GHz within restricted bands

ASSIGNED FREQUENCY BAND:	902.0 – 928.0 MHz
INVESTIGATED FREQUENCY RANGE:	1000 - 10000 MHz
TEST DISTANCE:	3 m
MODULATION:	PSK (worst case results)
MODULATING SIGNAL:	PRBS
BIT RATE:	60 kbps
DUTY CYCLE:	0.007 %
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
DETECTOR USED:	Peak
RESOLUTION BANDWIDTH:	1000 kHz
VIDEO BANDWIDTH (1 / Tx_{on})	1 kHz
TEST ANTENNA TYPE:	Double ridged guide

Frequency MHz	Antenna		Azimuth degrees*	Peak field strength(VBW=3 MHz			Average field strength(VBW=1 kHz)				Verdict
	Polarization	Height m		Measured dB(µV/m)	Limit, dB(µV/m	Margin, dB**	Measured dB(µV/m)	Calculated dB(µV/m)	Limit, dB(µV/m	Margin dB***	
Low carrier frequency											
976.70	V	1.10	000	52.00	74.00	-22.00	44.56	13.73	54.00	-40.27	Pass
2716.27	H	1.25	000	70.50	74.00	-3.50	67.36	36.53	54.00	-17.47	
3621.67	H	1.45	290	53.43	74.00	-20.57	50.13	19.30	54.00	-34.70	
4527.18	V	1.35	010	58.54	74.00	-15.46	53.49	22.66	54.00	-31.34	
5432.51	H	1.30	300	53.09	74.00	-20.91	47.23	16.40	54.00	-37.60	
8148.65	H	1.42	330	55.80	74.00	-18.20	51.40	20.57	54.00	-33.43	
Mid carrier frequency											
960.20	V	1.10	000	56.99	74.00	-17.01	51.67	20.84	54.00	-33.16	Pass
2743.45	H	1.25	000	68.94	74.00	-5.06	64.37	33.54	54.00	-20.46	
3657.78	H	1.45	290	51.82	74.00	-22.18	47.43	16.60	54.00	-37.40	
4572.48	V	1.35	010	56.85	74.00	-17.15	51.53	20.70	54.00	-33.30	
5487.35	H	1.30	300	53.83	74.00	-20.17	46.90	16.07	54.00	-37.93	
7316.00	H	1.40	330	54.95	74.00	-19.05	49.34	18.51	54.00	-35.49	
8230.50	H	1.42	330	54.70	74.00	-19.30	48.64	17.81	54.00	-36.19	
High carrier frequency											
960.00	V	1.10	000	60.43	74.00	-13.57	55.49	24.66	54.00	-29.34	Pass
2770.65	H	1.25	000	68.08	74.00	-5.92	64.34	33.51	54.00	-20.49	
3694.05	H	1.45	290	49.92	74.00	-24.08	44.86	14.03	54.00	-39.97	
4617.80	V	1.35	010	57.26	74.00	-16.74	52.21	21.38	54.00	-32.62	
5541.23	H	1.30	300	53.21	74.00	-20.79	47.34	16.51	54.00	-37.49	
7388.43	H	1.40	330	55.03	74.00	-18.97	50.65	19.82	54.00	-34.18	
8312.15	H	1.42	330	53.00	74.00	-21.00	45.93	15.10	54.00	-38.90	

*****- EUT front panel refers to 0 degrees position of turntable.
******- Margin = Measured field strength - specification limit.
***- Margin = Calculated field strength - specification limit,
where Calculated field strength = Measured field strength + average factor.

Table 7.3.4 Average factor calculation PSK modulation

Transmission pulse		Transmission burst		Transmission train duration, ms	Average factor, dB
Duration, ms	Period, ms	Duration, ms	Period, ms		
2.875	422.5	Continuous transmission			-30.83

*- Average factor was calculated as follows:

$$Average\ factor = 20 \times \log_{10}\left(\frac{2.875\ ms}{100\ ms} \times 1\right)$$

Test specification:	**Section 15.247(c), Radiated spurious emissions**		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date:	6/29/2010		
Temperature: 24.6 ºC	**Air Pressure:** 1006 hPa	**Relative Humidity:** 46 %	**Power Supply:** 3.6 V battery
Remarks:			

Table 7.3.5 Field strength of spurious emissions below 1 GHz within restricted bands

ASSIGNED FREQUENCY BAND:	902.0 – 928.0 MHz
INVESTIGATED FREQUENCY RANGE:	0.009 – 1000 MHz
TEST DISTANCE:	3 m
MODULATION:	PSK (worst case results)
MODULATING SIGNAL:	PRBS
BIT RATE:	60 kbps
DUTY CYCLE:	0.007%
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
RESOLUTION BANDWIDTH:	0.2 kHz (9 kHz – 150 kHz) 9.0 kHz (150 kHz – 30 MHz) 120 kHz (30 MHz – 1000 MHz)
VIDEO BANDWIDTH:	> Resolution bandwidth
TEST ANTENNA TYPE:	Active loop (9 kHz – 30 MHz) Biconilog (30 MHz – 1000 MHz)

Frequency MHz	Peak emission, dB(μV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
Low carrier frequency								
No emissions were found								Pass
Mid carrier frequency								
No emissions were found								Pass
High carrier frequency								
No emissions were found								Pass

*****- Margin = Measured emission - specification limit.
******- EUT front panel refer to 0 degrees position of turntable.

Table 7.3.6 Restricted bands

MHz	MHz	MHz	MHz	MHz	GHz
0.09 - 0.11	8.37625 - 8.38675	73 - 74.6	399.9 - 410	2690 - 2900	10.6 - 12.7
0.495 - 0.505	8.41425 - 8.41475	74.8 - 75.2	608 - 614	3260 - 3267	13.25 - 13.4
2.1735 - 2.1905	12.29 - 12.293	108 - 121.94	960 - 1240	3332 - 3339	14.47 - 14.5
4.125 - 4.128	12.51975 - 12.52025	123 - 138	1300 - 1427	3345.8 - 3358	15.35 - 16.2
4.17725 - 4.17775	12.57675 - 12.57725	149.9 - 150.05	1435 - 1626.5	3600 - 4400	17.7 - 21.4
4.20725 - 4.20775	13.36 - 13.41	156.52475 - 156.52525	1645.5 - 1646.5	4500 - 5150	22.01 - 23.12
6.215 - 6.218	16.42 - 16.423	156.7 - 156.9	1660 - 1710	5350 – 5460	23.6 - 24
6.26775 - 6.26825	16.69475 - 16.69525	162.0125 - 167.17	1718.8 - 1722.2	7250 - 7750	31.2 - 31.8
6.31175 - 6.31225	16.80425 - 16.80475	167.72 - 173.2	2200 - 2300	8025 – 8500	36.43 - 36.5
8.291 - 8.294	25.5 - 25.67	240 - 285	2310 - 2390	9000 - 9200	Above 38.6
8.362 - 8.366	37.5 - 38.25	322 - 335.4	2483.5 - 2500	9300 - 9500	

Reference numbers of test equipment used

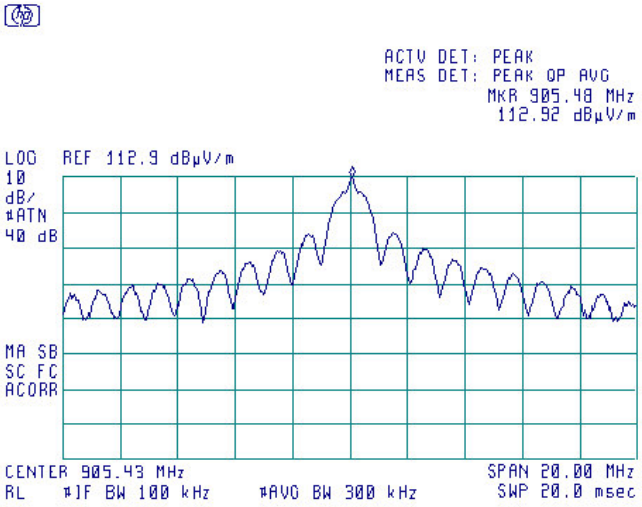
HL 0446	HL 0521	HL 0604	HL 2432	HL 2870	HL 2871	HL 3342	HL 3344
HL 3622	HL 3883						

Full description is given in Appendix A.

Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	6/29/2010		
Temperature: 24.6 ºC	Air Pressure: 1006 hPa	Relative Humidity: 46 %	Power Supply: 3.6 V battery
Remarks:			

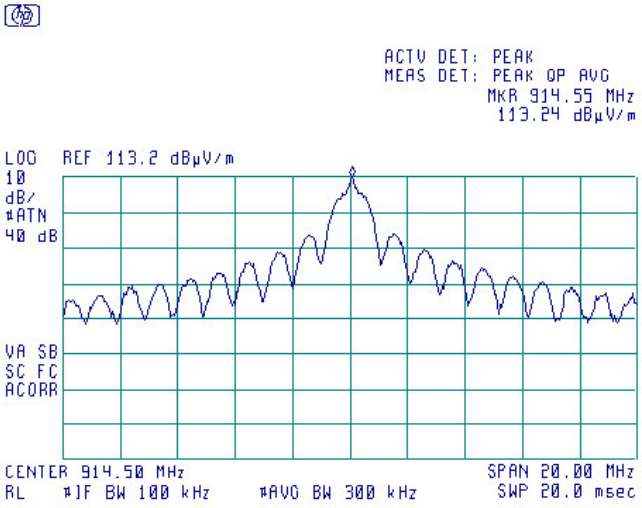
Plot 7.3.1 Radiated emission measurements at the low carrier frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical



Plot 7.3.2 Radiated emission measurements at the mid carrier frequency

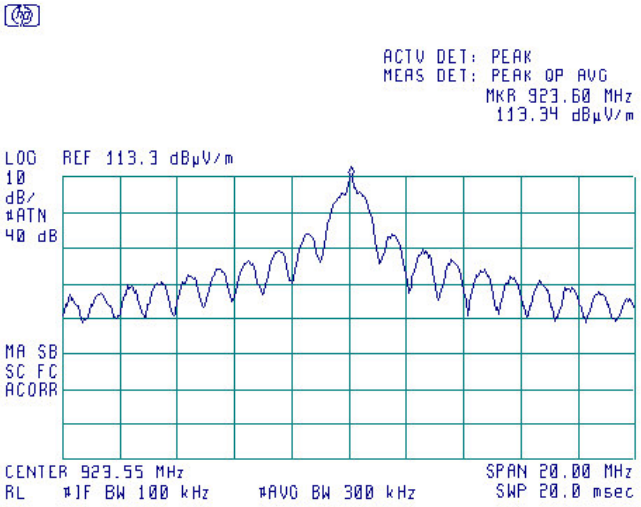
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical



Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	6/29/2010		
Temperature: 24.6 ºC	Air Pressure: 1006 hPa	Relative Humidity: 46 %	Power Supply: 3.6 V battery
Remarks:			

Plot 7.3.3 Radiated emission measurements at the high carrier frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical

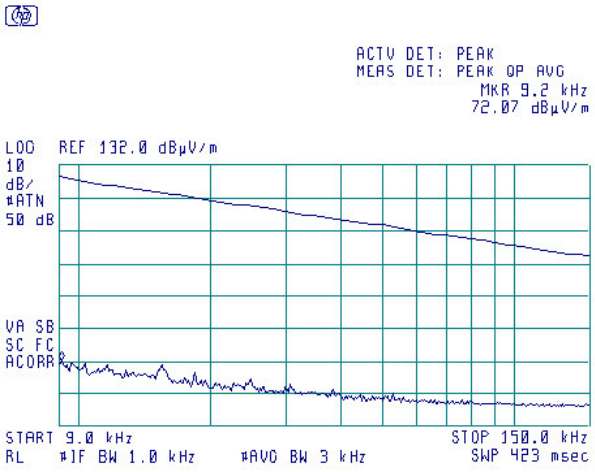


Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	6/29/2010		
Temperature: 24.6 ºC	Air Pressure: 1006 hPa	Relative Humidity: 46 %	Power Supply: 3.6 V battery
Remarks:			

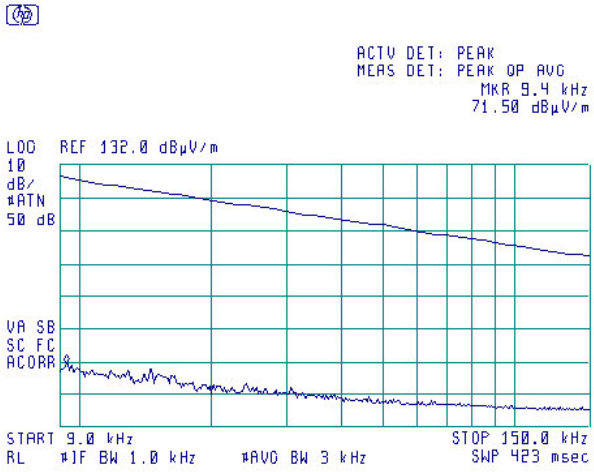
Plot 7.3.4 Radiated emission measurements from 9 to 150 kHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
DETECTOR Peak

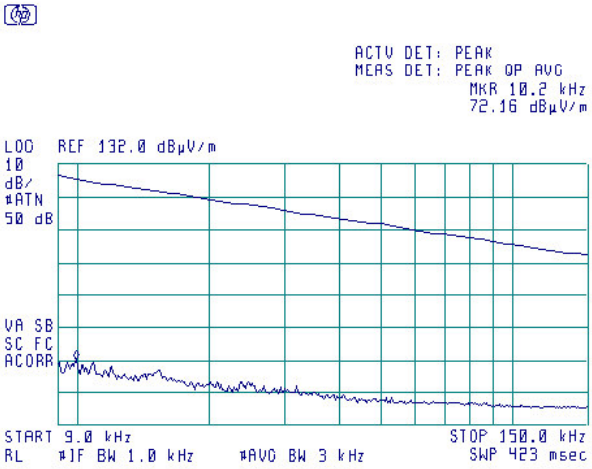
Low channel



Mid channel



High channel

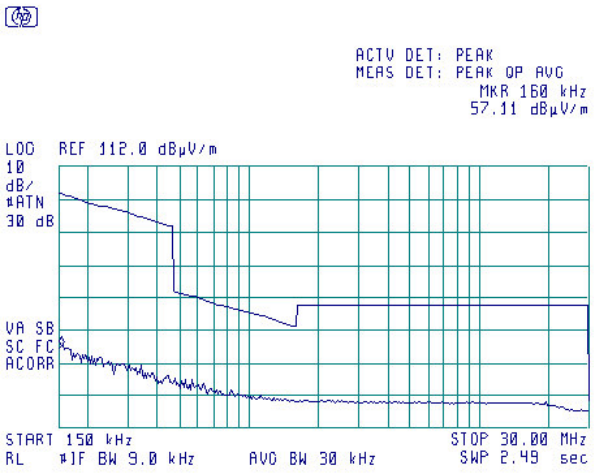


Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	6/29/2010		
Temperature: 24.6 ºC	Air Pressure: 1006 hPa	Relative Humidity: 46 %	Power Supply: 3.6 V battery
Remarks:			

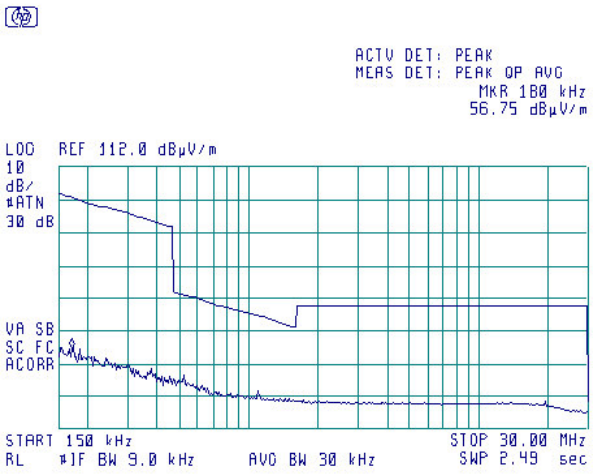
Plot 7.3.5 Radiated emission measurements from 0.15 to 30 MHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR Peak

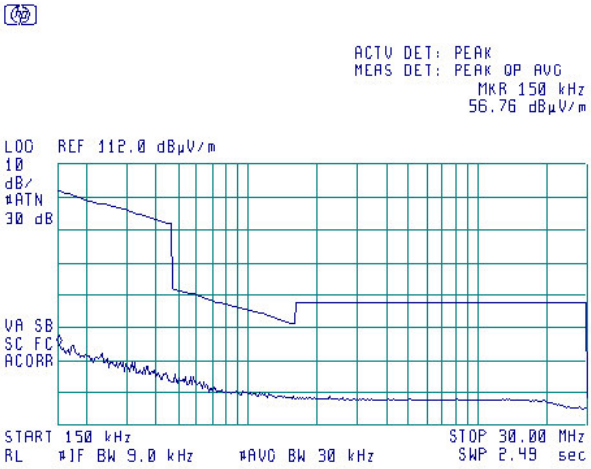
Low channel



Mid channel



High channel

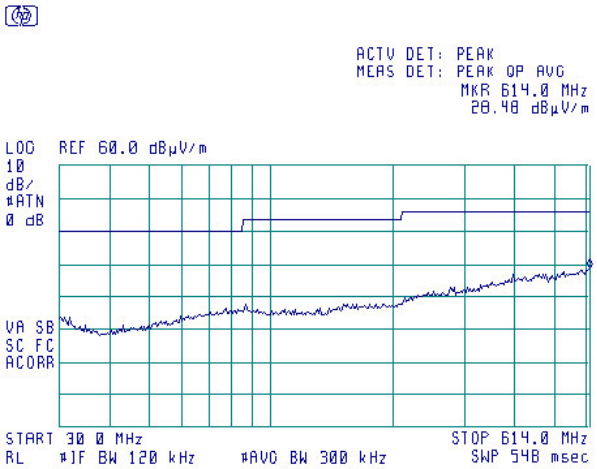


Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	6/29/2010		
Temperature: 24.6 ºC	Air Pressure: 1006 hPa	Relative Humidity: 46 %	Power Supply: 3.6 V battery
Remarks:			

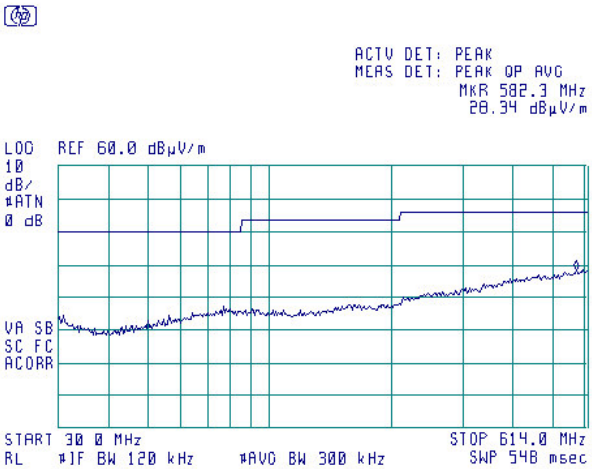
Plot 7.3.6 Radiated emission measurements from 30 to 614 MHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

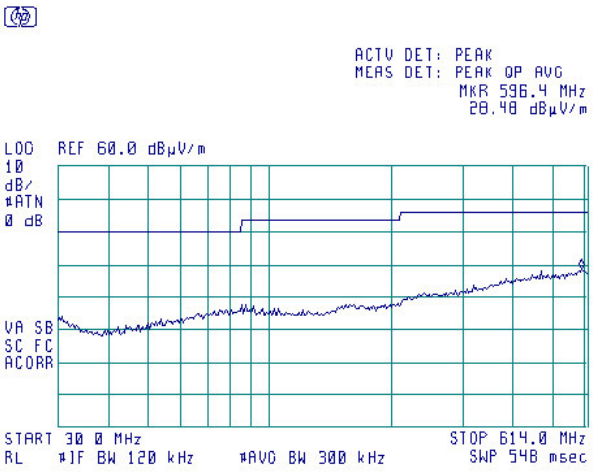
Low channel



Mid channel



High channel

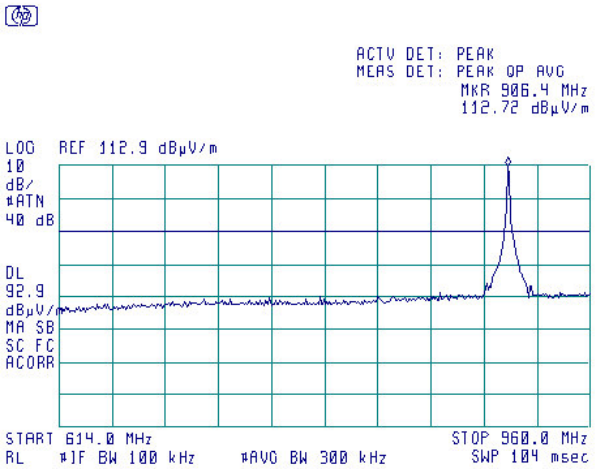


Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	6/29/2010		
Temperature: 24.6 ºC	Air Pressure: 1006 hPa	Relative Humidity: 46 %	Power Supply: 3.6 V battery
Remarks:			

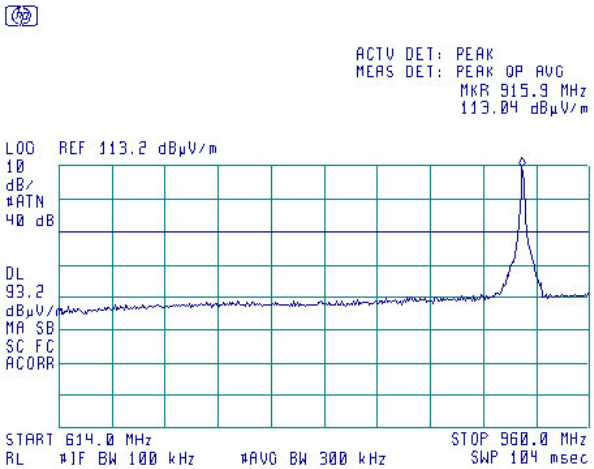
Plot 7.3.7 Radiated emission measurements from 614 to 960 MHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

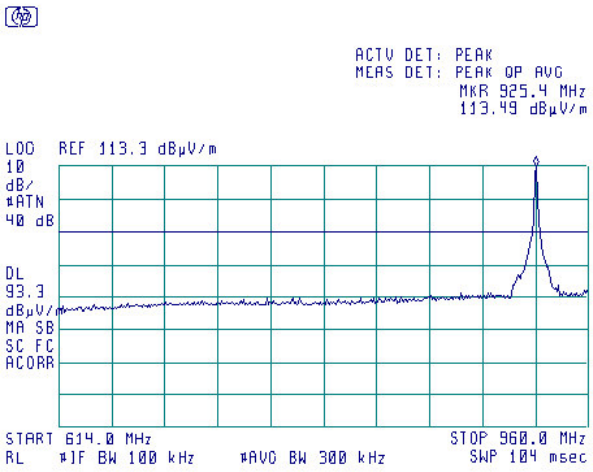
Low channel



Mid channel



High channel

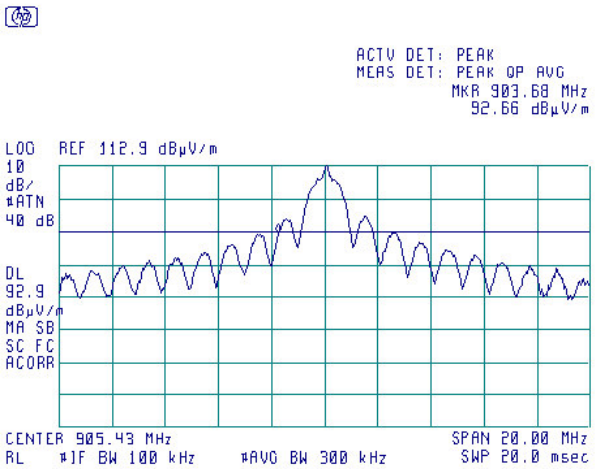


Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	6/29/2010		
Temperature: 24.6 ºC	Air Pressure: 1006 hPa	Relative Humidity: 46 %	Power Supply: 3.6 V battery
Remarks:			

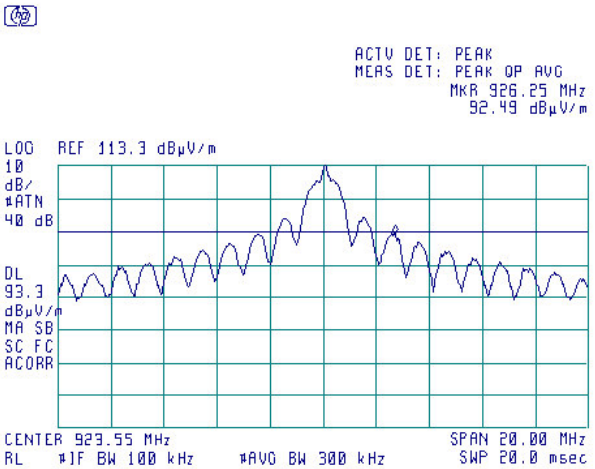
Plot 7.3.8 Radiated emission measurements at the lower and upper band edges

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

Low channel



High channel

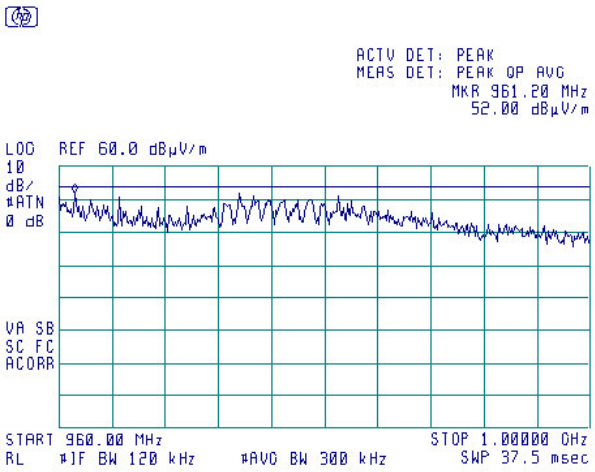


Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	6/29/2010		
Temperature: 24.6 ºC	Air Pressure: 1006 hPa	Relative Humidity: 46 %	Power Supply: 3.6 V battery
Remarks:			

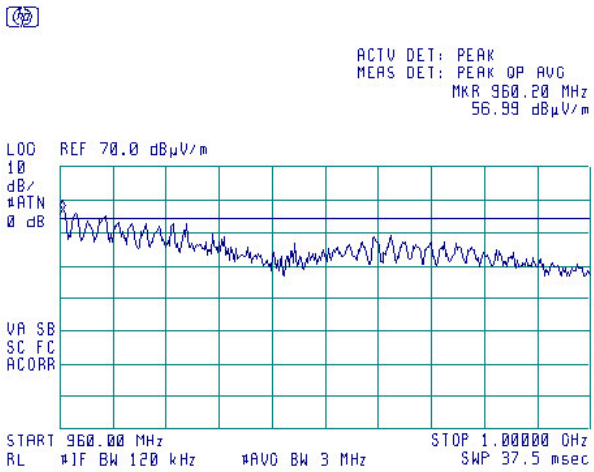
Plot 7.3.9 Radiated emission measurements from 960 to 1000 MHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR Peak

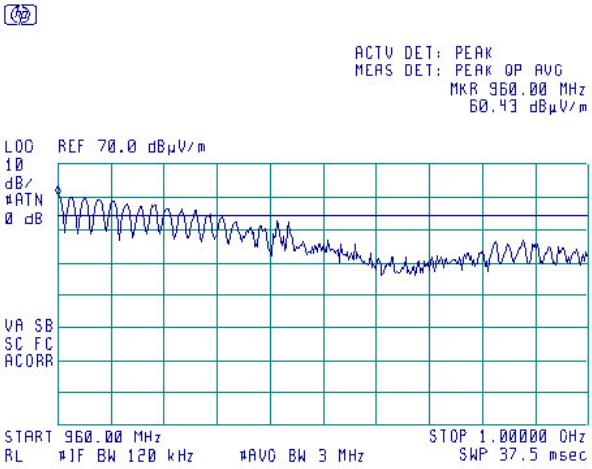
Low channel



Mid channel



High channel

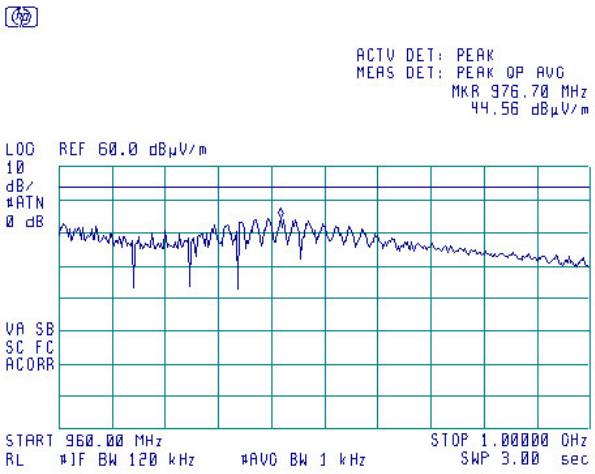


Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	6/29/2010		
Temperature: 24.6 ºC	Air Pressure: 1006 hPa	Relative Humidity: 46 %	Power Supply: 3.6 V battery
Remarks:			

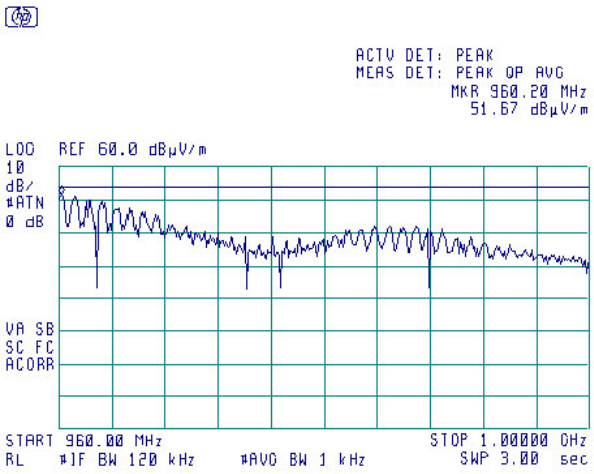
Plot 7.3.10 Radiated emission measurements from 960 to 1000 MHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR VBW = 1 kHz

Low channel



Mid channel



High channel