HERMON LABORATORIES

ELECTRICAL TESTING
0839.01

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PARTIAL TEST REPORT

ACCORDING TO: FCC CFR 47 part 22 subpart H, part 24 subpart E
RSS-132 issue 3, RSS-133 issue 6

FOR:

Visonic Ltd.
Control Panel (PSC 2G/3G module)
Model:PM-360
FCC ID:WP3PMASTER360
IC:1467C-PMASTER360

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1 Applicant information

Client name:	Visonic Ltd.
Address:	24 Habarzel street, Tel Aviv 69710, Israel
Telephone:	+972 3645 6832
Fax:	+972 3645 6788
E-mail:	zurir@tycoint.com
Contact name:	Mr. Zuri Rubin

2 Equipment under test attributes

Product name:	Cellular (PSC 2G/3G) module of Control Panel
Product type:	Transceiver
Model(s):	PM-360
Serial number:	1215140369
Hardware version:	90-207342
Software release:	JS-702974
Receipt date	12-Apr-15

3 Manufacturer information

Manufacturer name:	Visonic Ltd.
Address:	24 Habarzel street, Tel Aviv 69710, Israel
Telephone:	+972 3645 6832
Fax:	+972 3645 6788
E-Mail:	zurir@tycoint.com
Contact name:	Mr. Zuri Rubin

4 Test details

Project ID:	26893
Location:	Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started:	21-Apr-15
Test completed:	08-Jul-15
Test specification(s):	FCC 47 CFR part 22 subpart H; part 24 subpart E; RSS-132 issue 3:2013, RSS-133 issue 6:2013

5 Tests summary

Test	Status
Transmitter characteristics	
FCC section 22.913/RSS-132, RF power output	Pass
FCC section 22.917/RSS-132, Radiated spurious emissions	Pass
FCC section 24.232/RSS-133, RF power output	Pass
FCC section 24.238/RSS-133, Radiated spurious emissions	Pass

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. S. Samokha, test engineer Mrs. E. Pitt, test engineer	July 8, 2015	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	October 22, 2015	
Approved by:	Mr. M. Nikishin, EMC and Radio group manager	February 11, 2016	

6 EUT description

6.1 General information

The EUT, Control panel PM-360 is a wireless control panel powered via external AC/DC adaptor. The panel comprises four Visonic RF boards with below radio modules:

1. PG-2 module- communication within the alarm system in 902- 928 MHz band
2. WiFi module- approved by FCC ID:Z64-WL18SBMOD with Visonic antenna, connected to RF PCB

a. 802.11b

b. 802.11g

c. 802.11n HT20, 802.11n HT40.

3. Z-wave module with Visonic antenna connected to RF board
4. Cellular (PCS) module - modular approved with FCC ID:RI7UE910NA, IC: 5131A-UE910NA used for 3G/2G modes with Visonic antenna connected to RF board.

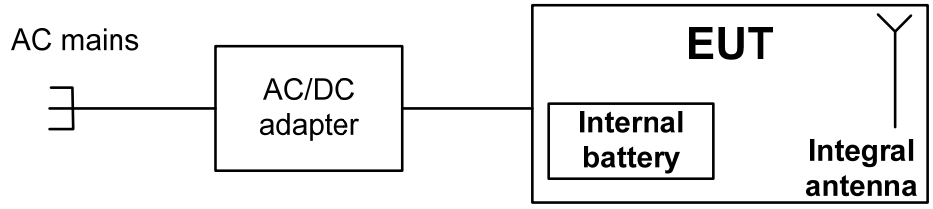
All radios could operate simalteneously.

The present test report involves the test results for certification of Class II permissive change of PCS 2G/3G module as a part of a composite application for certification.

6.2 Ports and lines

Port type	Port description	Connected from	Connected to	Qty.	Cable type	Cable length, m
Power	AC power	AC mains	AC/DC adaptor	1	Unshielded	2.0

6.3 Test configuration

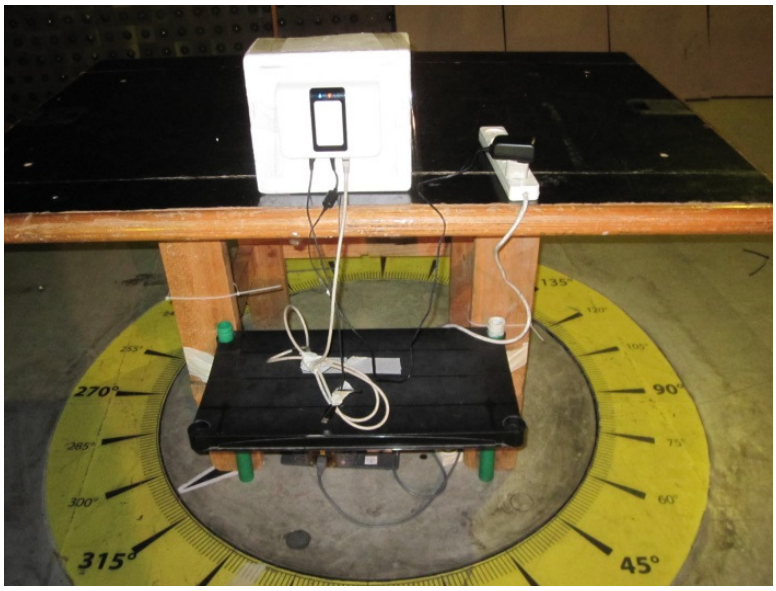


6.4 Changes made in the EUT

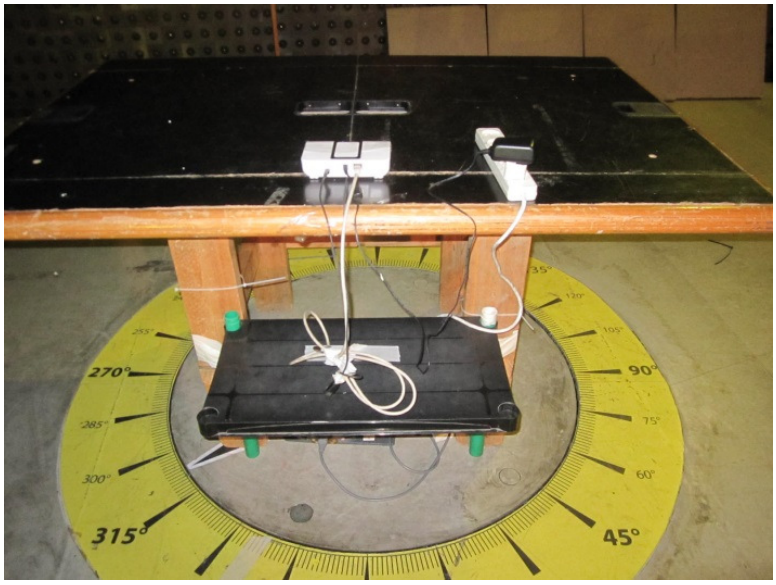
No changes were implemented in the EUT during the testing.

6.5 EUT test positions

Photograph 6.5.1 EUT in vertical position



Photograph 6.5.2 EUT in horizontal position



6.6 Transmitter characteristics, part 22

Type of equipment	
X	Stand-alone (Equipment with or without its own control provisions)
	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	824 – 849 MHz
Operating frequency range	824.2 – 848.8 MHz (2G mode) 826.4 – 846.6 MHz (3G mode)
Maximum rated output power (ERP)	34.04 dBm (2G mode); 26.93 dBm (3G mode)

Is transmitter output power variable?	X	No		
				continuous variable
				stepped variable with stepsize
				minimum RF power
				maximum RF power

Antenna connection				
unique coupling	standard connector	X	integral	with temporary RF connector without temporary RF connector

Antenna/s technical characteristics			
Type	Manufacturer	Model number	Gain
Integral	Visonic	H303518	3 dBi

Type of modulation	BPSK (2G mode), QPSK (3G mode)

Transmitter power source					
	Battery	**Nominal rated voltage**		Battery type	Lithium
	DC	**Nominal rated voltage**			
X	AC mains	**Nominal rated voltage**	120 VAC	Frequency	

Common power source for transmitter and receiver	X	yes	no

6.7 Transmitter characteristics, part 24

Type of equipment	
X	Stand-alone (Equipment with or without its own control provisions)
	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	1850.0 – 1910.0 MHz
Operating frequency range	1850.2 – 1909.8 MHz (2G mode) 1852.4 – 1907.6 MHz (3G mode)
Maximum rated output power (EIRP)	27.8 dBm (2G mode) 26.45 dBm (3G mode)

Is transmitter output power variable?	X	No		
				continuous variable
				stepped variable with stepsize
				minimum RF power
				maximum RF power

Antenna connection			
unique coupling	standard connector	X Integral	with temporary RF connector
			without temporary RF connector

Antenna/s technical characteristics			
Type	Manufacturer	Model number	Gain
Integral	Visonic	H303518	0 dBi

Type of modulation	BPSK (2G mode), QPSK (3G mode)

Transmitter power source					
	Battery	**Nominal rated voltage**		Battery type	Lithium
	DC	**Nominal rated voltage**			
X	AC mains	**Nominal rated voltage**	120 VAC	Frequency	

Common power source for transmitter and receiver	X	yes	no

Test specification:	Section 22.913/RSS-132, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Apr-15		
Temperature: 23.1 ºC	Air Pressure: 1018 hPa	Relative Humidity: 49 %	Power Supply: 120 VAC
Remarks: 2G module/ 3G module			

7 Transmitter tests according to 47CFR part 22 and RSS-132 requirements

7.1 Effective radiated power of carrier

7.1.1 General

This test was performed to measure effective radiated power emanated by transmitter at carrier frequency. Specification test limits are given in Table 7.1.1.

Table 7.1.1 Effective radiated power limit

Assigned frequency range, MHz	Peak output power		Equivalent field strength limit @ 3m, dB(μV/m)*
	W	dBm	
FCC part 22, ERP			
824 - 849	7.0	38.45	133.68
RSS-132, EIRP			
824 - 849	11.5	40.6	135.83

* - Equivalent field strength limit was calculated from maximum allowed ERP as follows: E=sqrt(30×P×1.64)/r, where P is ERP in Watts, 1.64 is numeric gain of ideal dipole and r is antenna to EUT distance in meters

7.1.2 Test procedure for field strength measurements

7.1.2.1 The EUT was set up as shown in Figure 7.1.1, energized and the performance check was conducted.

7.1.2.2 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, the measuring antenna height was swept throughout the range, specified in Table 7.1.2, in both vertical and horizontal polarizations.

7.1.2.3 The worst test results (the lowest margins) were recorded in Table 7.1.2, Table 7.1.4 and shown in the associated plots.

7.1.3 Test procedure for substitution ERP measurements

7.1.3.1 The test equipment was set up as shown in Figure 7.1.2 and energized.

7.1.3.2 RF signal generator was set to the EUT carrier frequency and the RF output level was preliminary adjusted to produce the same field strength as it was measured from the EUT.

7.1.3.3 The test antenna height was swept throughout the specified in Table 7.1.2, Table 7.1.4 range to find maximum emission from substitution antenna and RF signal generator output was fine adjusted to produce the same field strength as it was measured from the EUT.

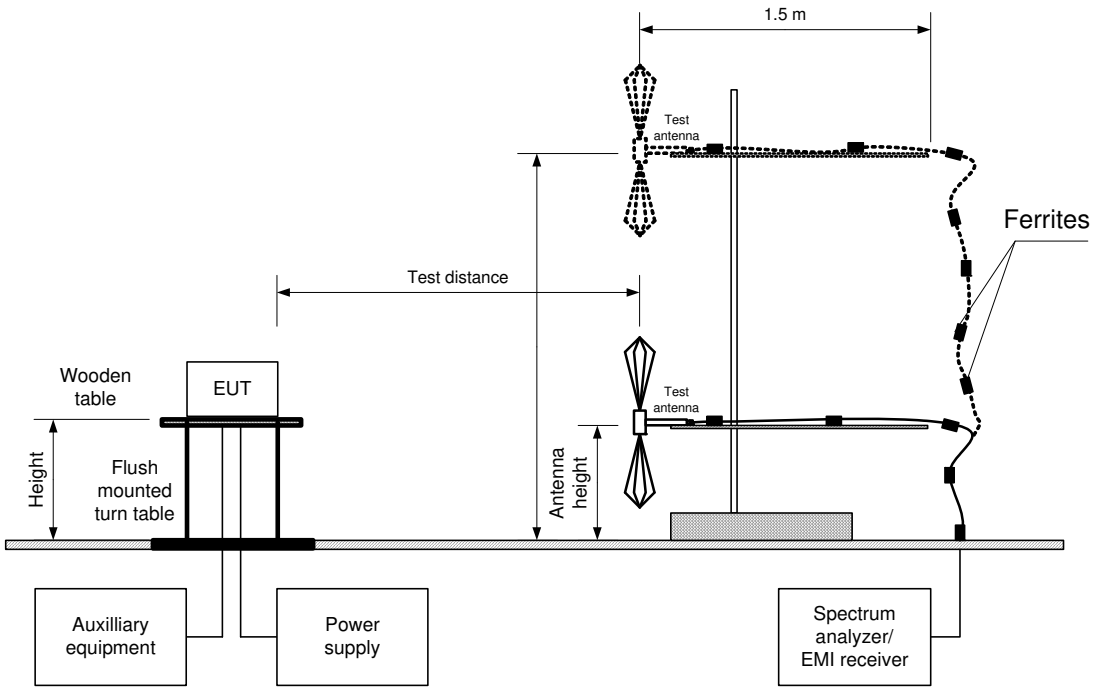
7.1.3.4 The ERP was calculated as a sum of signal generator output power in dBm and antenna gain in dBd reduced by cable loss in dB.

7.1.3.5 The above procedure was performed in both horizontal and vertical polarizations of the test antenna.

7.1.3.6 The worst test results (the lowest margins) were recorded in Table 7.1.3, Table 7.1.5 and shown in the associated plots.

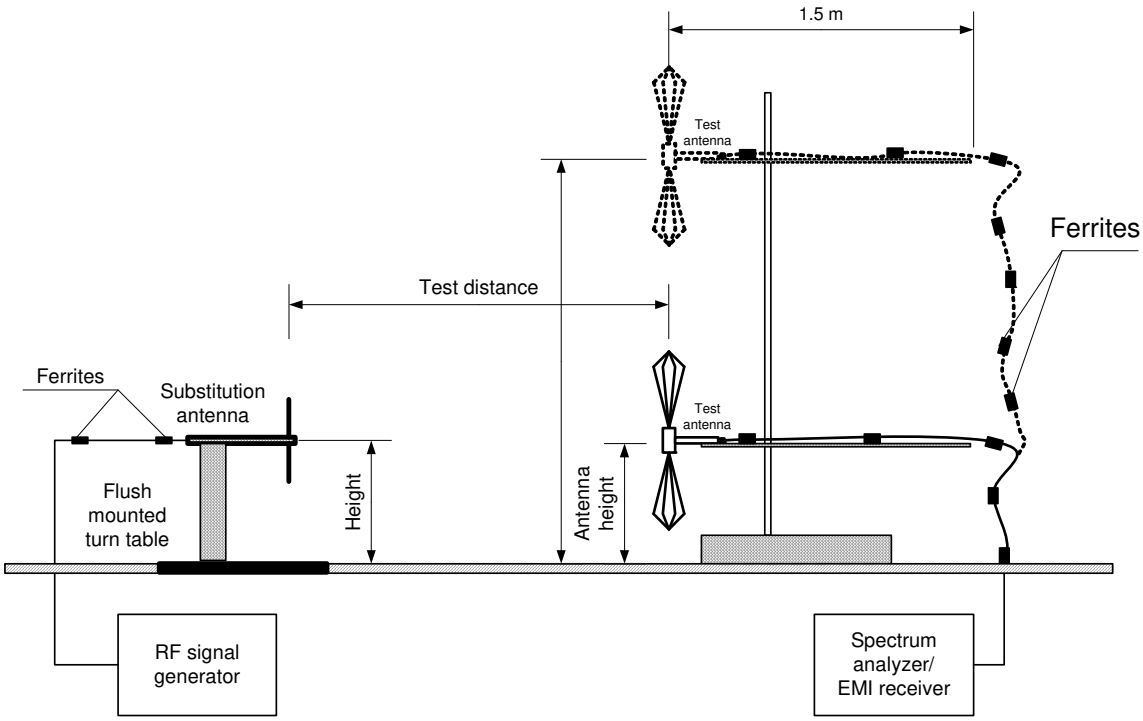
Test specification:	Section 22.913/RSS-132, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Apr-15		
Temperature: 23.1 ºC	Air Pressure: 1018 hPa	Relative Humidity: 49 %	Power Supply: 120 VAC
Remarks: 2G module/ 3G module			

Figure 7.1.1 Setup for carrier field strength measurements



Test specification:	Section 22.913/RSS-132, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Apr-15		
Temperature: 23.1 ºC	Air Pressure: 1018 hPa	Relative Humidity: 49 %	Power Supply: 120 VAC
Remarks: 2G module/ 3G module			

Figure 7.1.2 Setup for substitution ERP measurements



Test specification:	**Section 22.913/RSS-132, Peak output power**		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	21-Apr-15		
Temperature: 23.1 ºC	**Air Pressure:** 1018 hPa	**Relative Humidity:** 49 %	**Power Supply:** 120 VAC
Remarks: 2G module			

Table 7.1.2 Transmitter carrier field strength of 2G module

ASSIGNED FREQUENCY RANGE: 824.0-849.0 MHz
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
EUT HEIGHT: 0.8 m
TEST ANTENNA HEIGHTS RANGE: 1.0 – 4.0 m
DETECTOR USED: Peak
VIDEO BANDWIDTH: > Resolution bandwidth
TEST ANTENNA TYPE: Biconical

Frequency, MHz	Field strength, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees
824.18	132.66	133.68	-1.02	1000	Horizontal	1.0	157
836.15	131.86	133.68	-1.82		Horizontal	1.0	153
848.73	131.45	133.68	-2.23		Horizontal	1.0	157

*- Margin = Field strength – calculated field strength limit.
**- EUT front panel refers to 0 degrees position of turntable.

Table 7.1.3 Transmitter carrier ERP of 2G module

TEST DISTANCE: 3 m
SUBSTITUTION ANTENNA HEIGHT: 0.8 m
TEST ANTENNA HEIGHTS RANGE: 1.0 – 4.0 m
DETECTOR USED: Peak
VIDEO BANDWIDTH: 3000 kHz
SUBSTITUTION ANTENNA TYPE: Tunable dipole

Frequency, MHz	Field strength, dB(μV/m)	RBW, kHz	Antenna polarization	RF generator output, dBm	Ant gain, dBd	Cable loss, dB	ERP, dBm	Limit, dBm	Margin, dB*	Verdict
824.18	132.66	1000	Horizontal	38.00	-2.13	1.83	34.04	38.45	-4.41	Pass
836.15	131.86		Horizontal	36.99	-2.00	1.84	33.15	38.45	-5.30	Pass
848.73	131.45		Horizontal	36.44	-1.87	1.86	32.71	38.45	-5.74	Pass

*- Margin = ERP – specification limit.

-2dBi

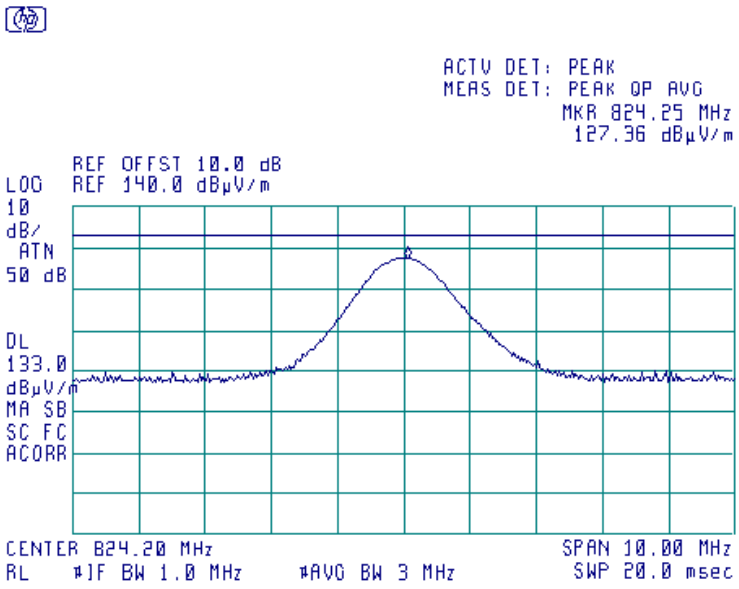
Reference numbers of test equipment used

HL 0521	HL 0604	HL 0661	HL 1565	HL 2871	HL 4279	HL 4353	

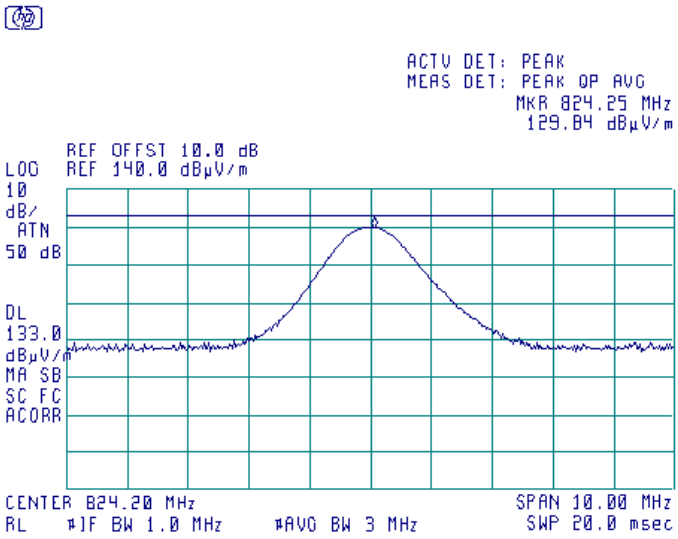
Full description is given in Appendix A.

Test specification:	Section 22.913/RSS-132, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Apr-15		
Temperature: 23.1 ºC	Air Pressure: 1018 hPa	Relative Humidity: 49 %	Power Supply: 120 VAC
Remarks: 2G module			

Plot 7.1.1 Transmitter carrier field strength at low frequency in vertical antenna polarization, EUT vertical position

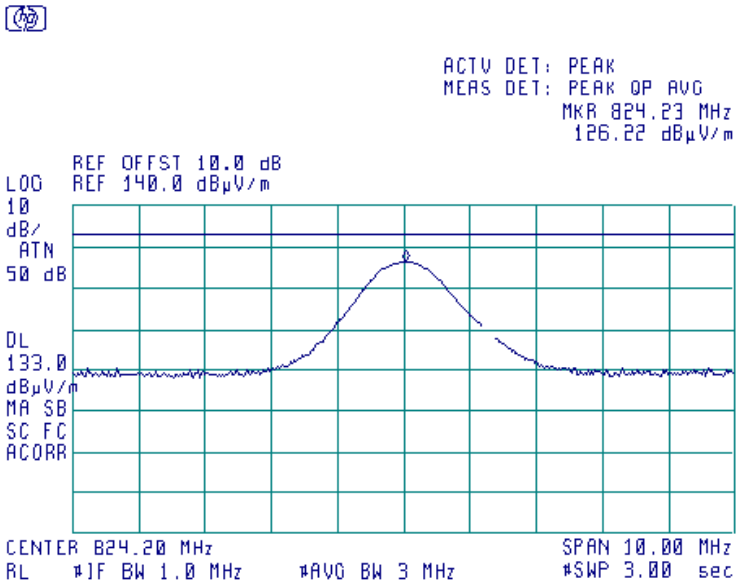


Plot 7.1.2 Transmitter carrier field strength at low frequency in horizontal antenna polarization, EUT vertical position

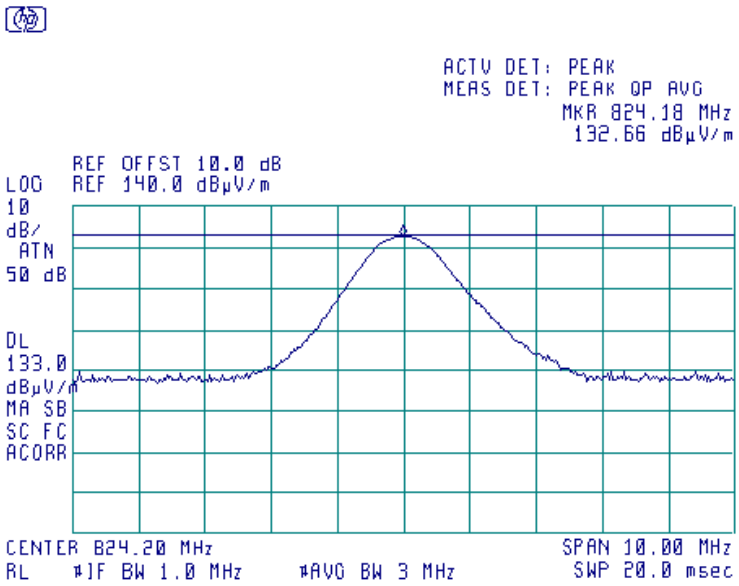


Test specification:	Section 22.913/RSS-132, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Apr-15		
Temperature: 23.1 ºC	Air Pressure: 1018 hPa	Relative Humidity: 49 %	Power Supply: 120 VAC
Remarks: 2G module			

Plot 7.1.3 Transmitter carrier field strength at low frequency in vertical antenna polarization, EUT horizontal position

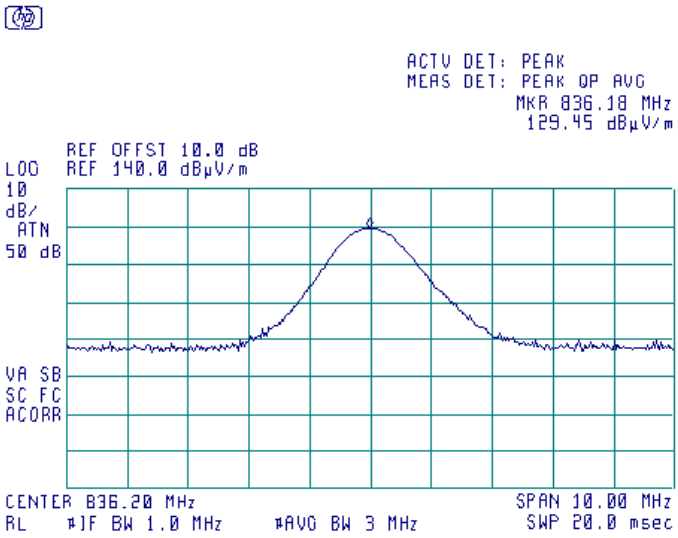


Plot 7.1.4 Transmitter carrier field strength at low frequency in horizontal antenna polarization, EUT horizontal position

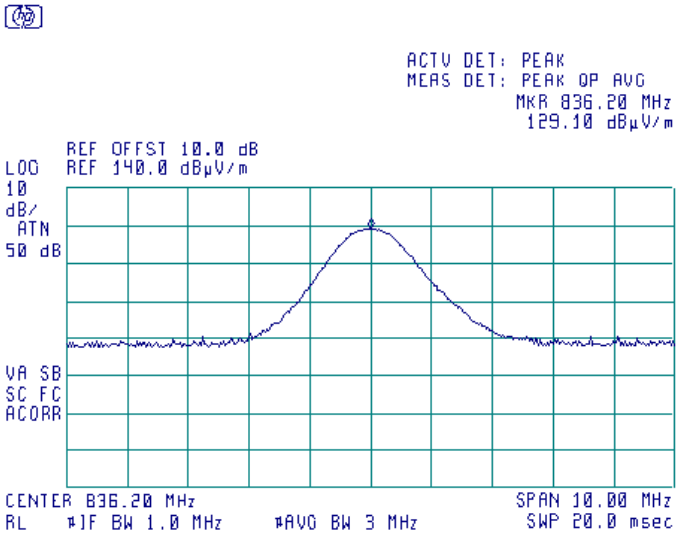


Test specification:	Section 22.913/RSS-132, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Apr-15		
Temperature: 23.1 ºC	Air Pressure: 1018 hPa	Relative Humidity: 49 %	Power Supply: 120 VAC
Remarks: 2G module			

Plot 7.1.5 Transmitter carrier field strength at mid frequency in vertical antenna polarization, EUT vertical position

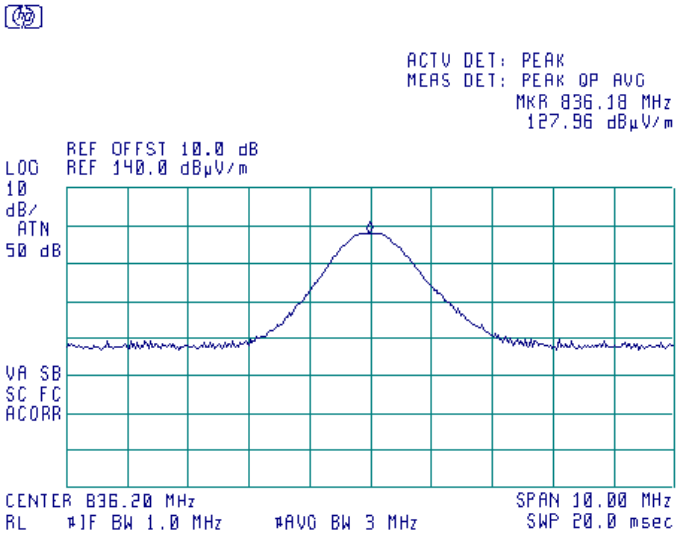


Plot 7.1.6 Transmitter carrier field strength at mid frequency in horizontal antenna polarization, EUT vertical position

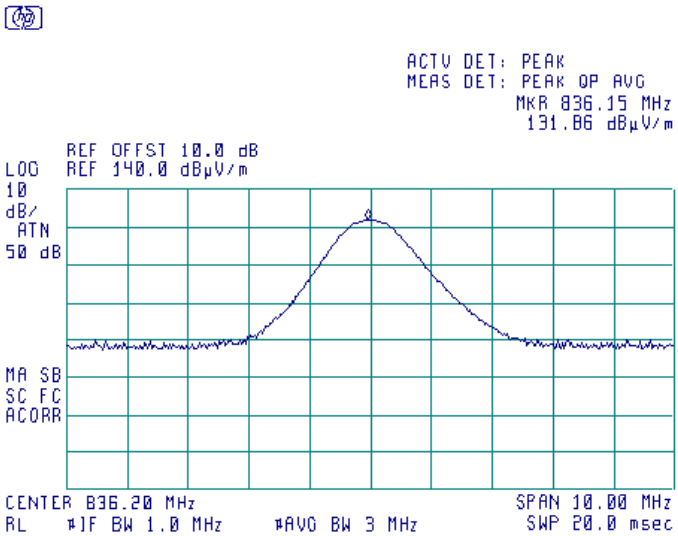


Test specification:	Section 22.913/RSS-132, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Apr-15		
Temperature: 23.1 ºC	Air Pressure: 1018 hPa	Relative Humidity: 49 %	Power Supply: 120 VAC
Remarks: 2G module			

Plot 7.1.7 Transmitter carrier field strength at mid frequency in vertical antenna polarization, EUT horizontal position

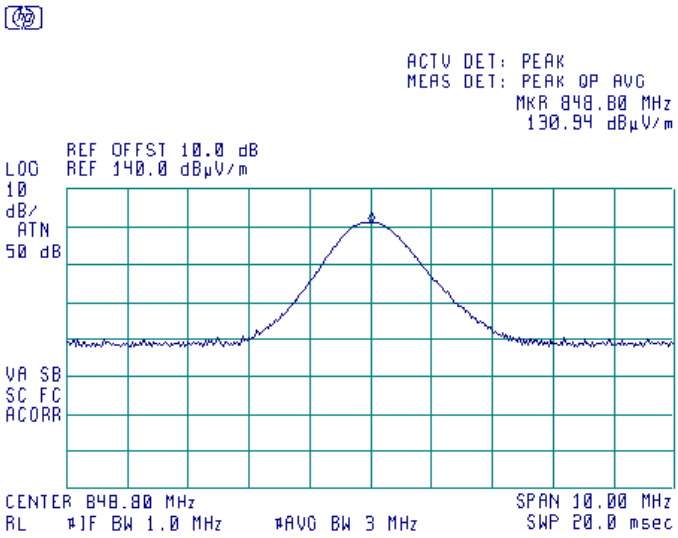


Plot 7.1.8 Transmitter carrier field strength at mid frequency in horizontal antenna polarization, EUT horizontal position

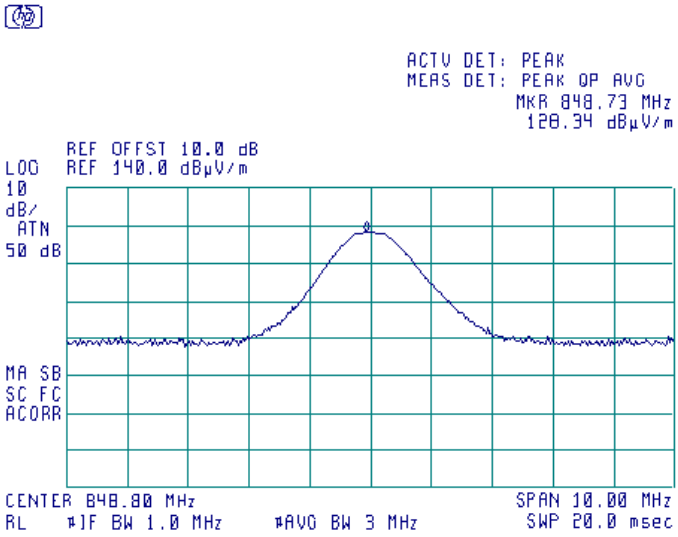


Test specification:	Section 22.913/RSS-132, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Apr-15		
Temperature: 23.1 ºC	Air Pressure: 1018 hPa	Relative Humidity: 49 %	Power Supply: 120 VAC
Remarks: 2G module			

Plot 7.1.9 Transmitter carrier field strength at high frequency in vertical antenna polarization, EUT vertical position

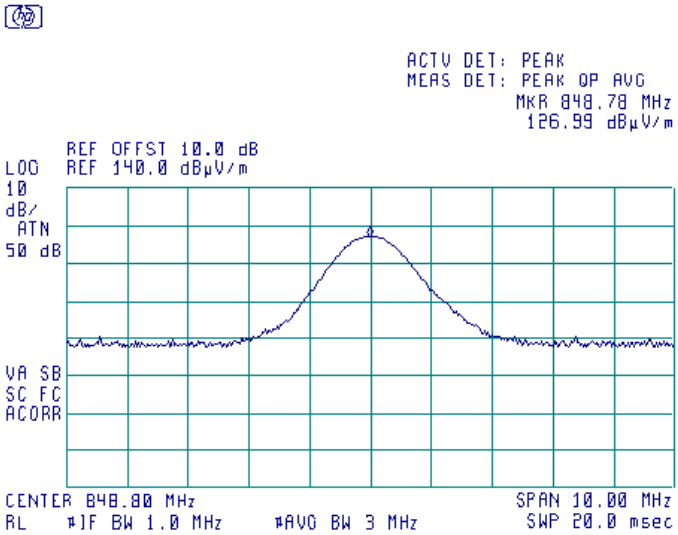


Plot 7.1.10 Transmitter carrier field strength at high frequency in horizontal antenna polarization, EUT vertical position

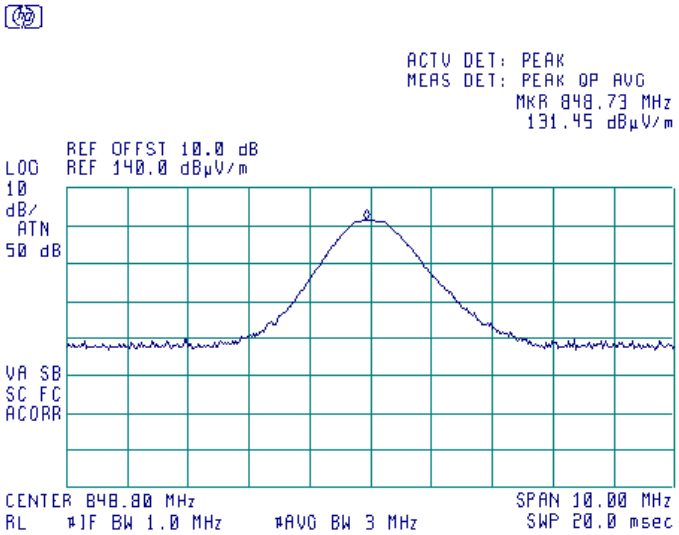


Test specification:	Section 22.913/RSS-132, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Apr-15		
Temperature: 23.1 ºC	Air Pressure: 1018 hPa	Relative Humidity: 49 %	Power Supply: 120 VAC
Remarks: 2G module			

Plot 7.1.11 Transmitter carrier field strength at high frequency in vertical antenna polarization, EUT horizontal position



Plot 7.1.12 Transmitter carrier field strength at high frequency in horizontal antenna polarization, EUT horizontal position



Test specification:	Section 22.913/RSS-132, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	09-Jun-15		
Temperature: 21 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 3G module			

Table 7.1.4 Transmitter carrier field strength of 3G module

ASSIGNED FREQUENCY RANGE: 824.0-849.0 MHz
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
EUT HEIGHT: 0.8 m
TEST ANTENNA HEIGHTS RANGE: 1.0 – 4.0 m
DETECTOR USED: Peak
VIDEO BANDWIDTH: > Resolution bandwidth
TEST ANTENNA TYPE: Biconical

Frequency, MHz	Field strength, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees
826.40	122.53	133.68	-11.15	3000	Horizontal	1.0	340
836.40	124.96	133.68	-8.72		Horizontal	1.0	236
846.60	125.14	133.68	-8.54		Vertical	1.0	184

*- Margin = Field strength – calculated field strength limit.
**- EUT front panel refers to 0 degrees position of turntable.

Table 7.1.5 Transmitter carrier ERP of 3G module

TEST DISTANCE: 3 m
SUBSTITUTION ANTENNA HEIGHT: 0.8 m
TEST ANTENNA HEIGHTS RANGE: 1.0 – 4.0 m
DETECTOR USED: Peak
VIDEO BANDWIDTH: 3000kHz
SUBSTITUTION ANTENNA TYPE: Tunable dipole

Frequency, MHz	Field strength, dB(μV/m)	RBW, kHz	Antenna polarization	RF generator output, dBm	Ant gain, dBd	Cable loss, dB	ERP, dBm	Limit, dBm	Margin, dB*	Verdict
826.40	122.53	3000	Horizontal	27.91	-2.10	1.83	23.98	38.45	-14.47	Pass
836.40	124.96		Horizontal	30.39	-2.00	1.84	26.55	38.45	-11.90	Pass
846.60	125.14		Vertical	30.69	-1.90	1.86	26.93	38.45	-11.52	Pass

*- Margin = ERP – specification limit.

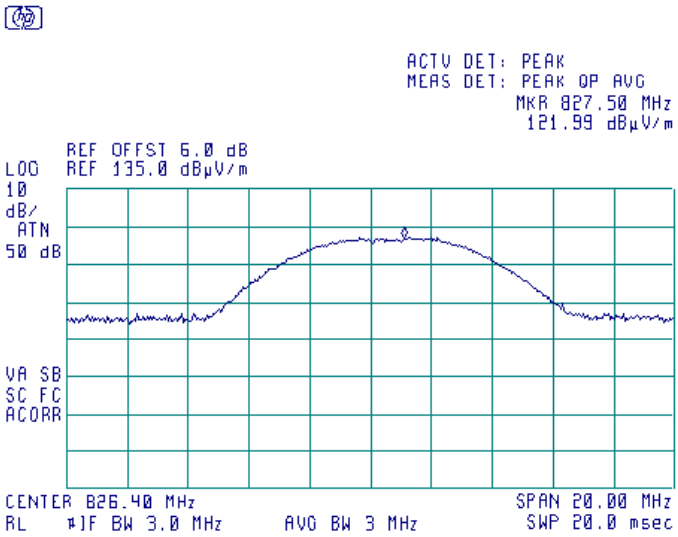
Reference numbers of test equipment used

HL 0521	HL 0604	HL 0661	HL 1565	HL 2871	HL 4279	HL 4353	

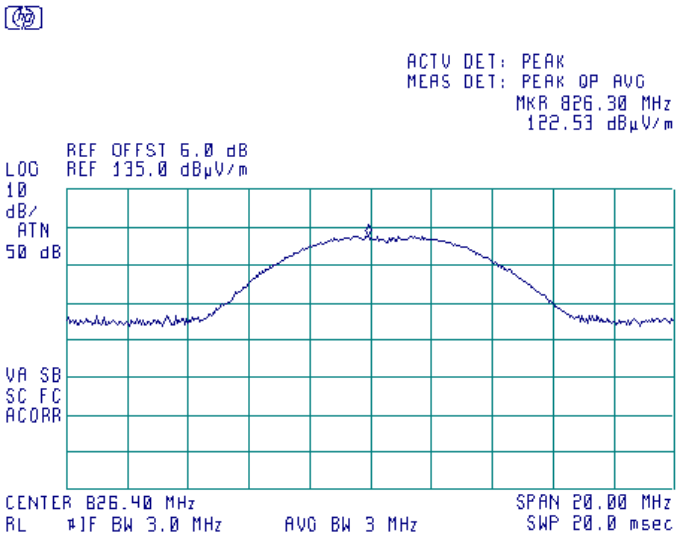
Full description is given in Appendix A.

Test specification:	Section 22.913/RSS-132, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	09-Jun-15		
Temperature: 21 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 3G module			

Plot 7.1.13 Transmitter carrier field strength at low frequency in vertical antenna polarization, EUT vertical position

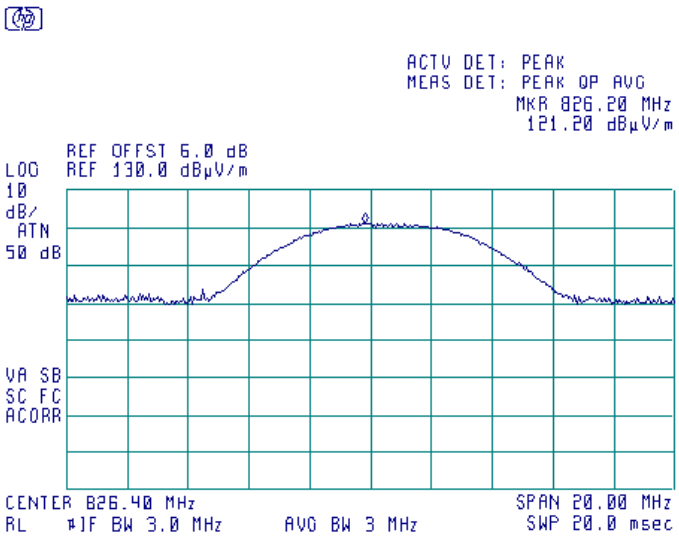


Plot 7.1.14 Transmitter carrier field strength at low frequency in horizontal antenna polarization, EUT vertical position

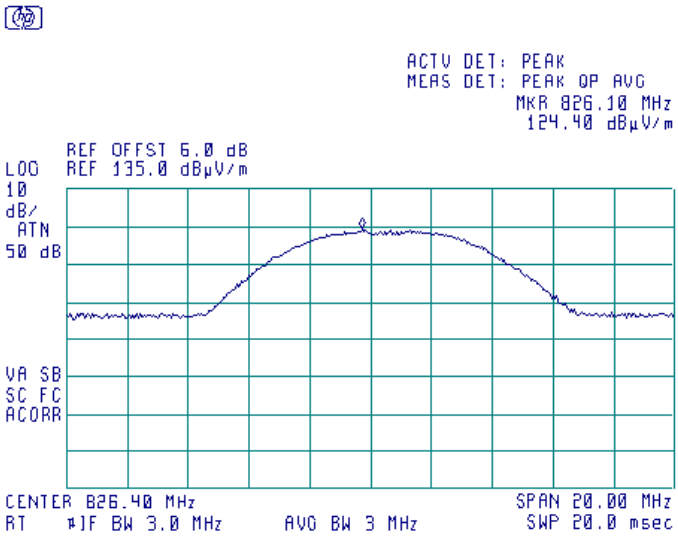


Test specification:	Section 22.913/RSS-132, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	09-Jun-15		
Temperature: 21 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 3G module			

Plot 7.1.15 Transmitter carrier field strength at low frequency in vertical antenna polarization, EUT horizontal position

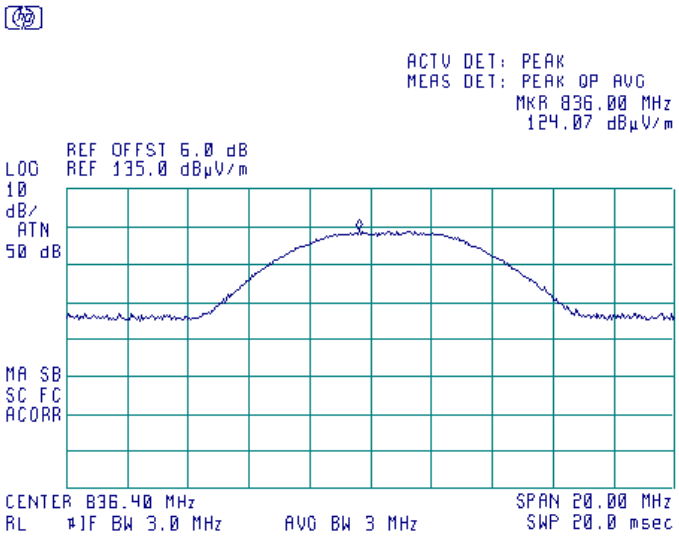


Plot 7.1.16 Transmitter carrier field strength at low frequency in horizontal antenna polarization, EUT horizontal position

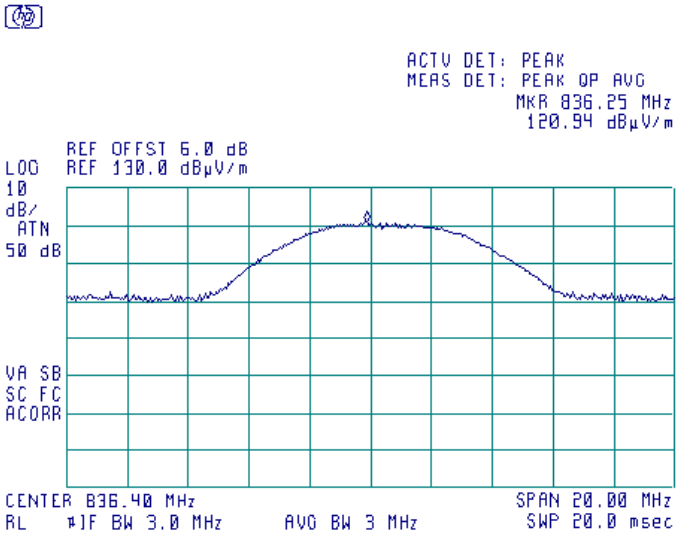


Test specification:	Section 22.913/RSS-132, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	09-Jun-15		
Temperature: 21 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 3G module			

Plot 7.1.17 Transmitter carrier field strength at mid frequency in vertical antenna polarization, EUT vertical position

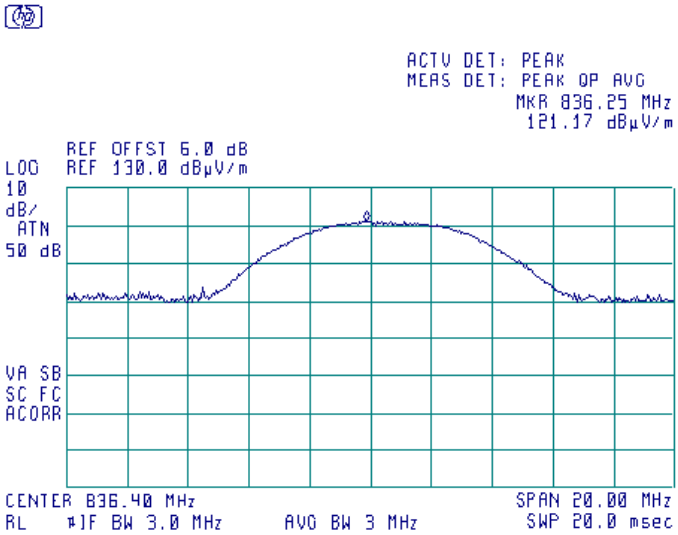


Plot 7.1.18 Transmitter carrier field strength at mid frequency in horizontal antenna polarization, EUT vertical position

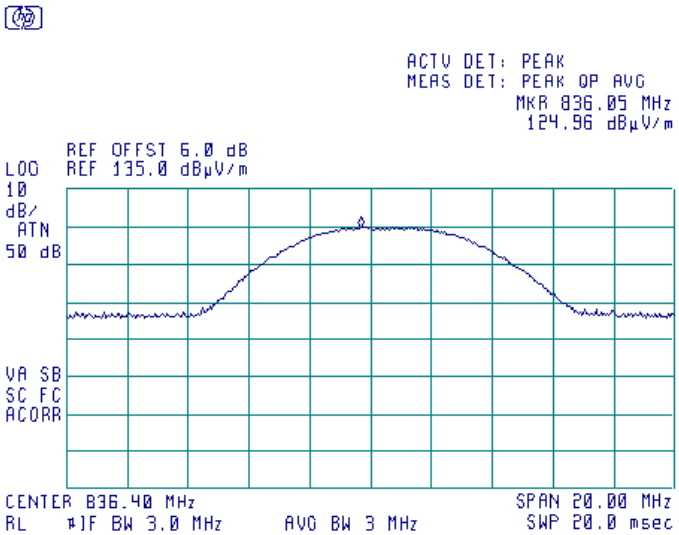


Test specification:	Section 22.913/RSS-132, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	09-Jun-15		
Temperature: 21 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 3G module			

Plot 7.1.19 Transmitter carrier field strength at mid frequency in vertical antenna polarization, EUT horizontal position

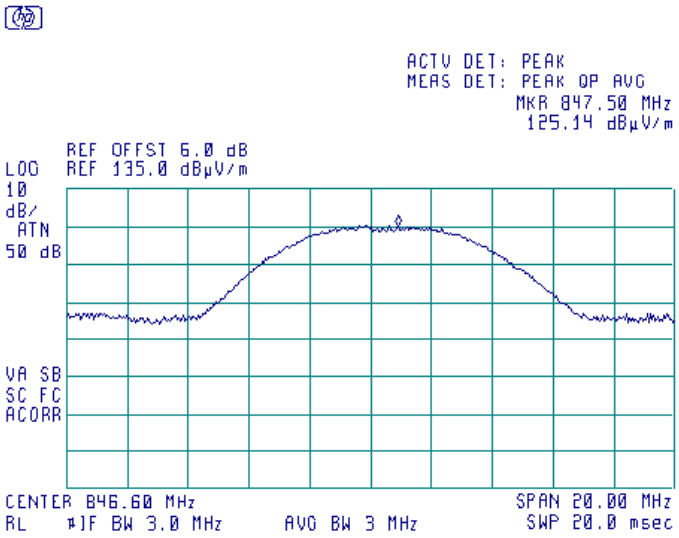


Plot 7.1.20 Transmitter carrier field strength at mid frequency in horizontal antenna polarization, EUT horizontal position

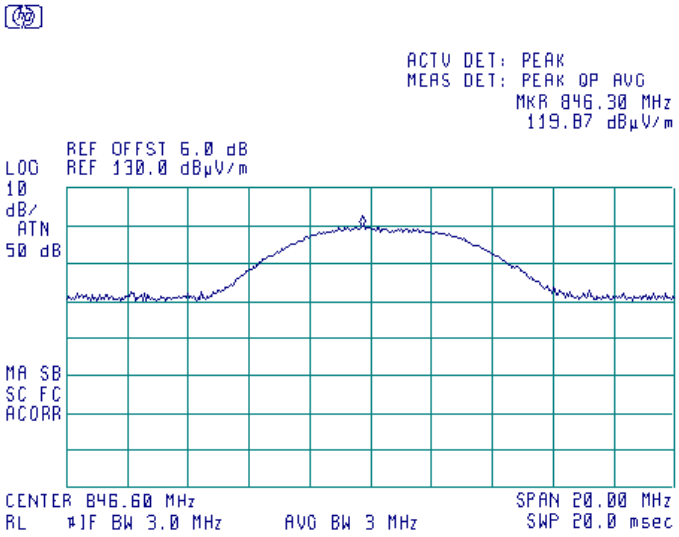


Test specification:	Section 22.913/RSS-132, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	09-Jun-15		
Temperature: 21 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 3G module			

Plot 7.1.21 Transmitter carrier field strength at high frequency in vertical antenna polarization, EUT vertical position

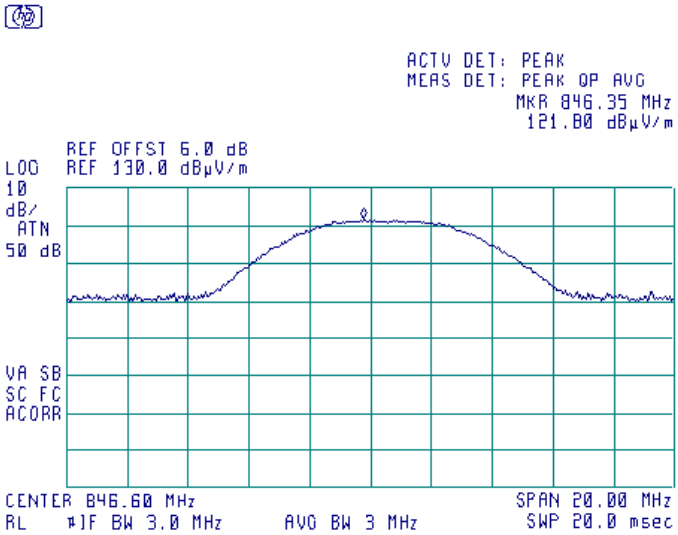


Plot 7.1.22 Transmitter carrier field strength at high frequency in horizontal antenna polarization, EUT vertical position

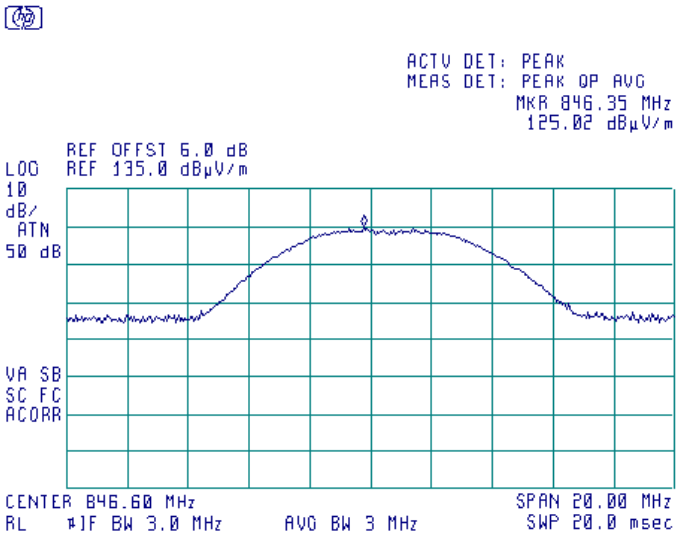


Test specification:	Section 22.913/RSS-132, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	09-Jun-15		
Temperature: 21 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 3G module			

Plot 7.1.23 Transmitter carrier field strength at high frequency in vertical antenna polarization, EUT horizontal position



Plot 7.1.24 Transmitter carrier field strength at high frequency in horizontal antenna polarization, EUT horizontal position



Test specification:	Section 22.917/RSS-132, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 22.917; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Apr-15 - 08-Jul-15		
Temperature: 22 ºC	Air Pressure: 1009 hPa	Relative Humidity: 53 %	Power Supply: 120 VAC
Remarks: 3G module			

7.2 Radiated spurious emission measurements of 3G module

7.2.1 General

This test was performed to measure radiated spurious emissions from the EUT. Specification test limits are given in Table 7.1.1.

Table 7.2.1 Radiated spurious emission test limits

Frequency, MHz	Attenuation below carrier, dBc	ERP of spurious, dBm	Equivalent field strength limit @ 3m, dB(μV/m)***
0.009 – 10th harmonic*	43+10logP**	-13	84.4

* - Excluding the in band emission within ± 250 % of the authorized bandwidth from the carrier
** - P is transmitter output power in Watts
*** - Equivalent field strength limit was calculated from maximum allowed ERP of spurious as follows: E=sqrt(30×P×1.64)/r, where P is ERP in Watts, 1.64 is numeric gain of ideal dipole and r is antenna to EUT distance in meters

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

7.2.2.1 The EUT was set up as shown in Figure 7.2.1, energized and the performance check was conducted.

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

7.2.2.3 The worst test results (the lowest margins) were recorded in Table 7.1.2 and shown in the associated plots.

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

7.2.3.1 The EUT was set up as shown in Figure 7.2.2, energized and the performance check was conducted.

7.2.3.2 The specified frequency range was investigated with antenna connected to spectrum analyzer. To find maximum radiation the turntable was rotated 360^0 and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal, polarizations.

7.2.3.3 The worst test results (the lowest margins) were recorded in Table 7.1.2 and shown in the associated plots.

Test specification:	**Section 22.917/RSS-132, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 22.917; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	22-Apr-15 - 08-Jul-15		
Temperature: 22 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 53 %	**Power Supply:** 120 VAC
Remarks: 3G module			

Figure 7.2.1 Setup for spurious emission field strength measurements in 9 kHz to 30 MHz band

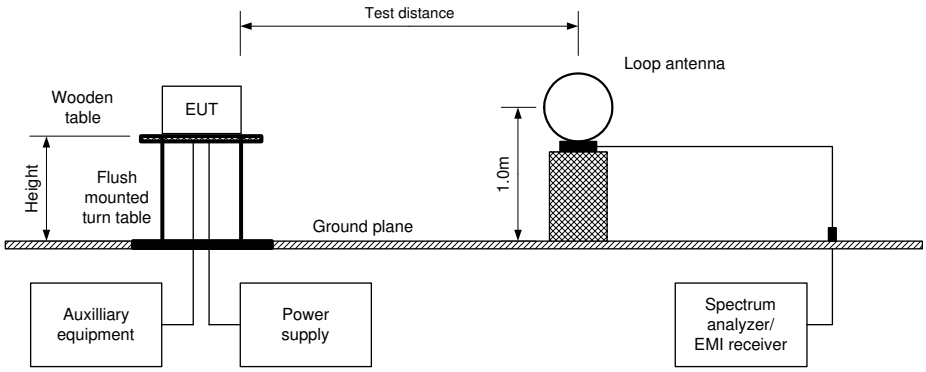
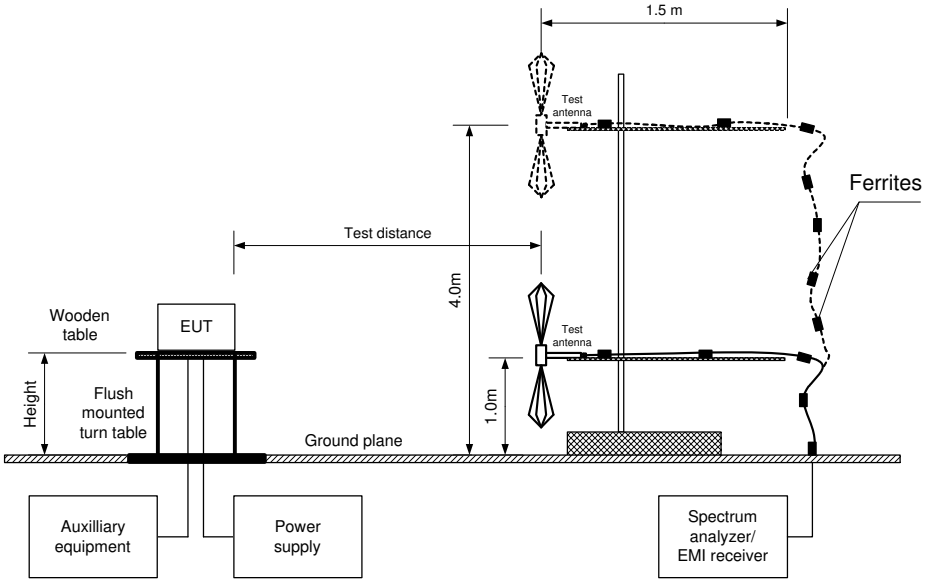


Figure 7.2.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:	Section 22.917/RSS-132, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 22.917; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Apr-15 - 08-Jul-15		
Temperature: 22 ºC	Air Pressure: 1009 hPa	Relative Humidity: 53 %	Power Supply: 120 VAC
Remarks: 3G module			

Table 7.2.2 Spurious emission field strength test results

ASSIGNED FREQUENCY RANGE:	824-849 MHz
TEST DISTANCE:	3 m
TEST SITE:	Semi anechoic chamber
EUT HEIGHT:	0.8 m
INVESTIGATED FREQUENCY RANGE:	0.009 – 9000 MHz
DETECTOR USED:	Peak
VIDEO BANDWIDTH:	> Resolution bandwidth
TEST ANTENNA TYPE:	Active loop (9 kHz – 30 MHz) Biconilog (30 MHz – 1000 MHz) Double ridged guide (above 1000 MHz)
MODULATING SIGNAL:	PRBS

Frequency, MHz	Field strength, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height	Turn-table position**, degrees
Low carrier frequency 826.4 MHz							
824.001	80.24	84.4	-4.16	120	Horizontal	1.0	340
Mid carrier frequency 836.4 MHz							
No emissions were found							
High carrier frequency 846.6 MHz							
848.999	79.66	84.4	-4.94	120	Vertical	1.0	184

*- Margin = Field strength of spurious – calculated field strength limit.
**- EUT front panel refers to 0 degrees position of turntable.

Table 7.2.3 Substitution ERP of spurious emission test results

TEST DISTANCE:	3 m
SUBSTITUTION ANTENNA HEIGHT:	0.8 m
TEST ANTENNA HEIGHTS RANGE:	1.0 – 4.0 m
DETECTOR USED:	Peak
VIDEO BANDWIDTH:	3000kHz
SUBSTITUTION ANTENNA TYPE:	Tunable dipole

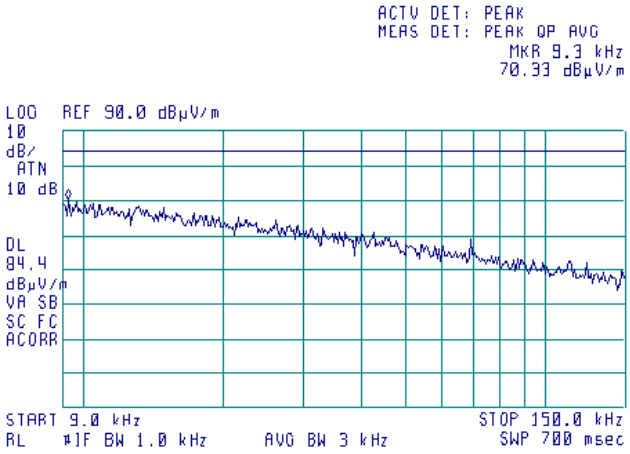
Frequency, MHz	Field strength, dB(μV/m)	RBW, kHz	Antenna polarization	RF generator output, dBm	Ant gain, dBi	Cable loss, dB	ERP, dBm	Limit, dBm	Margin, dB*	Verdict
Low carrier frequency 826.4 MHz										
824.001	80.24	300	Horizontal	-14.42	0.02	1.83	-16.23	-13.00	-3.23	Pass
High carrier frequency 846.6 MHz										
848.999	79.66	300	Vertical	-15.35	0.28	1.86	-16.93	-13.00	-3.93	Pass

*- Margin = ERP – specification limit.

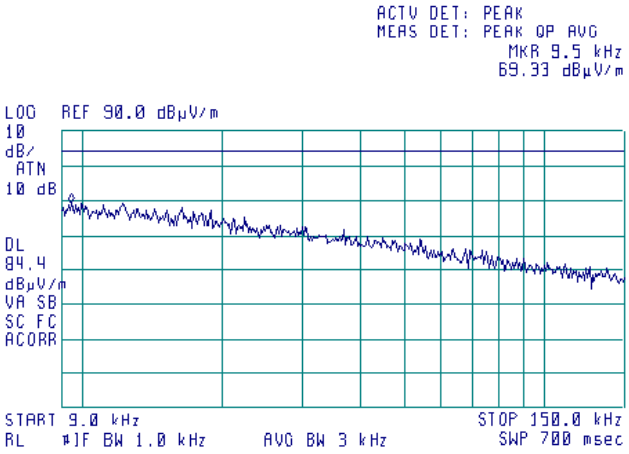
Test specification:	**Section 22.917/RSS-132, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 22.917; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	22-Apr-15 - 08-Jul-15		
Temperature: 22 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 53 %	**Power Supply:** 120 VAC
Remarks: 3G module			

Plot 7.2.1 Radiated emission measurements in 9 - 150 kHz range

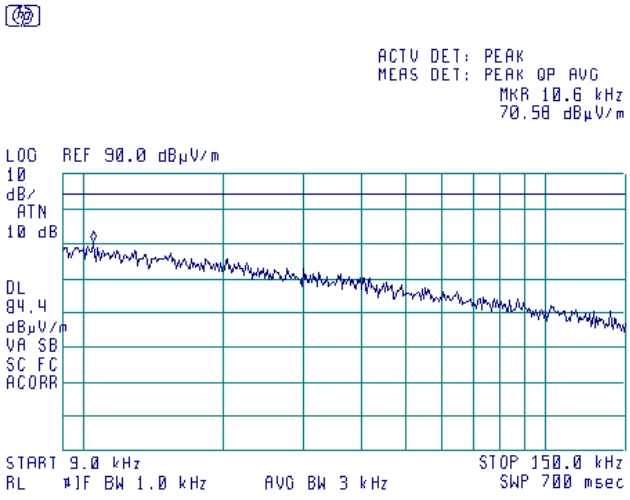
TEST SITE: Semi anechoic chamber
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
CARRIER FREQUENCY: Low



CARRIER FREQUENCY: Mid



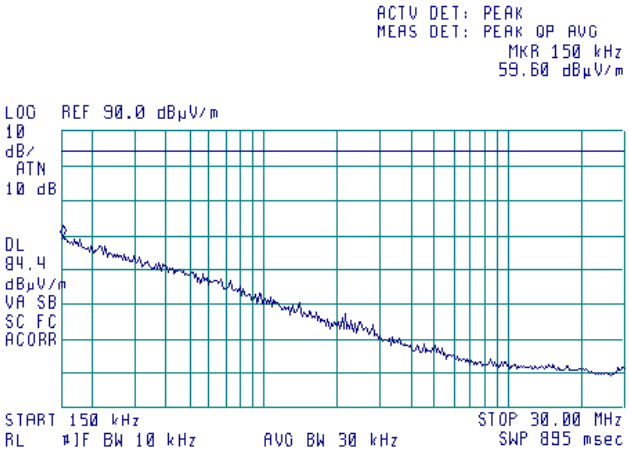
CARRIER FREQUENCY: High



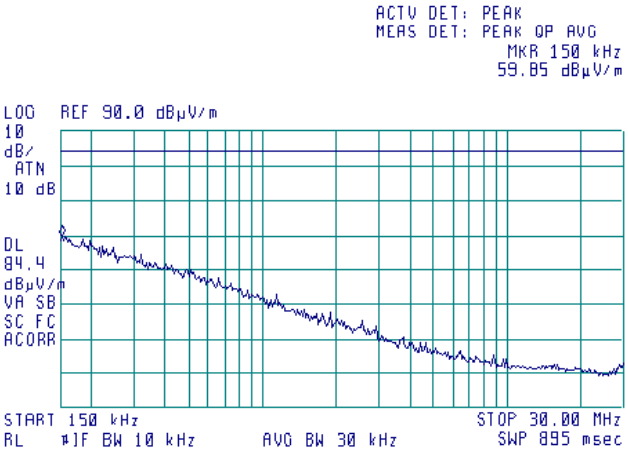
Test specification:	**Section 22.917/RSS-132, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 22.917; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	22-Apr-15 - 08-Jul-15		
Temperature: 22 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 53 %	**Power Supply:** 120 VAC
Remarks: 3G module			

Plot 7.2.2 Radiated emission measurements in 0.15 - 30 MHz range

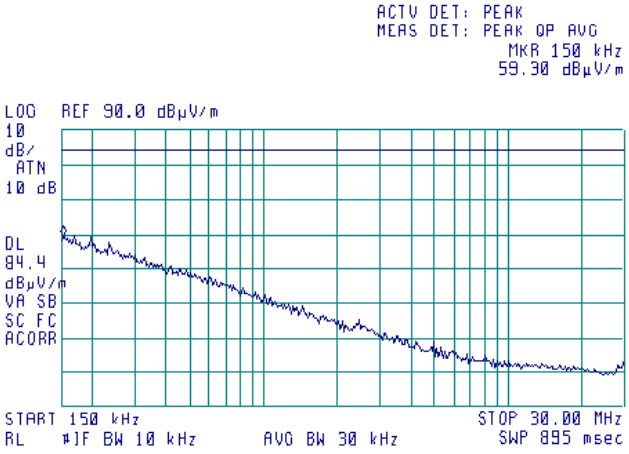
TEST SITE: Semi anechoic chamber
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
CARRIER FREQUENCY: Low



CARRIER FREQUENCY: Mid



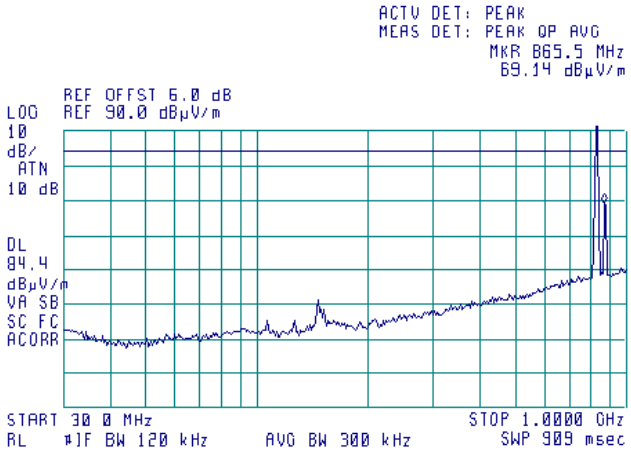
CARRIER FREQUENCY: High

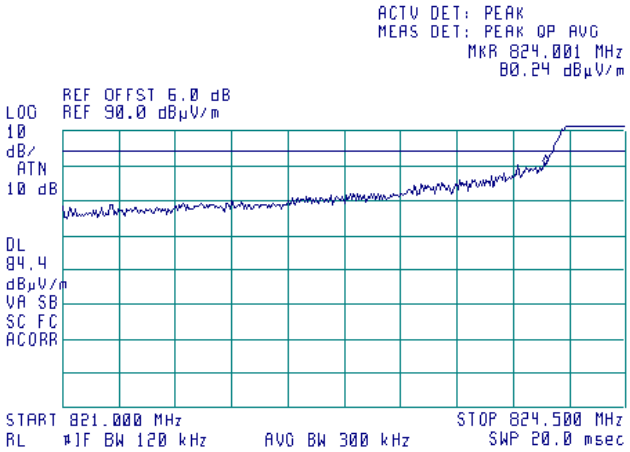


Test specification:	**Section 22.917/RSS-132, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 22.917; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	22-Apr-15 - 08-Jul-15		
Temperature: 22 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 53 %	**Power Supply:** 120 VAC
Remarks: 3G module			

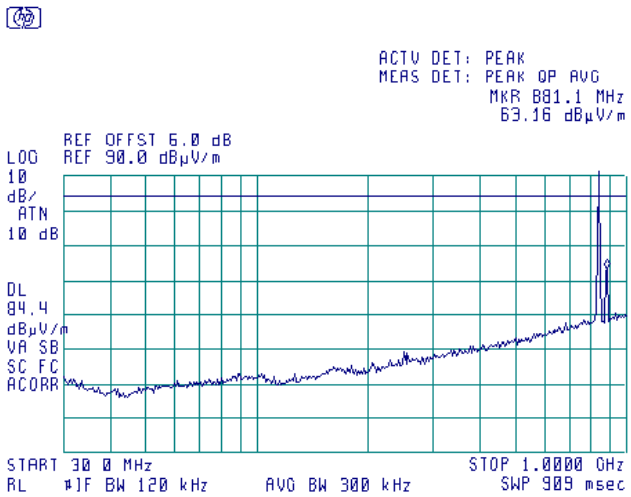
Plot 7.2.3 Radiated emission measurements in 30 - 1000 MHz range

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





CARRIER FREQUENCY: Mid

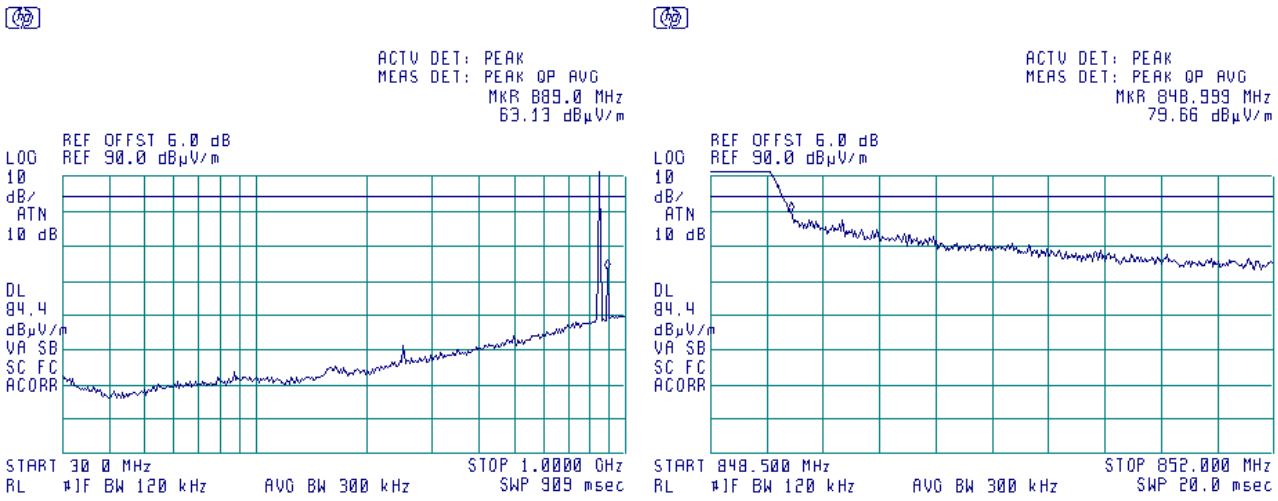


NOTE: 871.4 MHz, 881.4 MHz and 891.6 MHz are the auxiliary base station signals

Test specification:	**Section 22.917/RSS-132, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 22.917; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	22-Apr-15 - 08-Jul-15		
Temperature: 22 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 53 %	**Power Supply:** 120 VAC
Remarks: 3G module			

Plot 7.2.4 Radiated emission measurements in 30 - 1000 MHz range

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

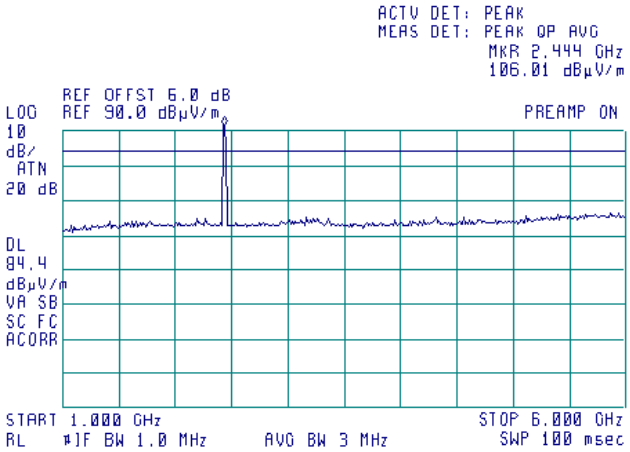


NOTE: 871.4 MHz, 881.4 MHz and 891.6 MHz are the auxiliary base station signals

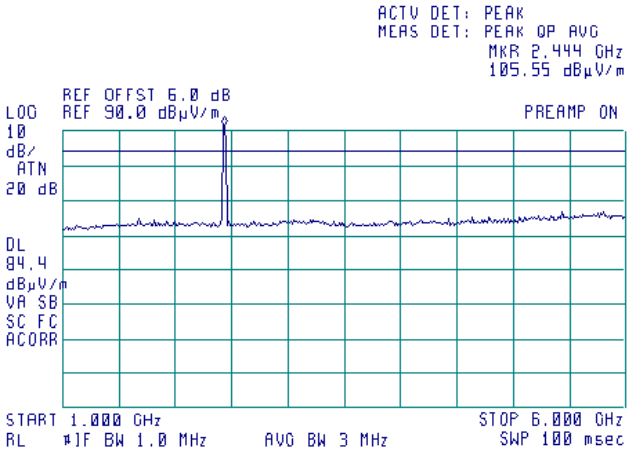
Test specification:	Section 22.917/RSS-132, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 22.917; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Apr-15 - 08-Jul-15		
Temperature: 22 ºC	Air Pressure: 1009 hPa	Relative Humidity: 53 %	Power Supply: 120 VAC
Remarks: 3G module			

Plot 7.2.5 Radiated emission measurements in 1000 – 6000 MHz range

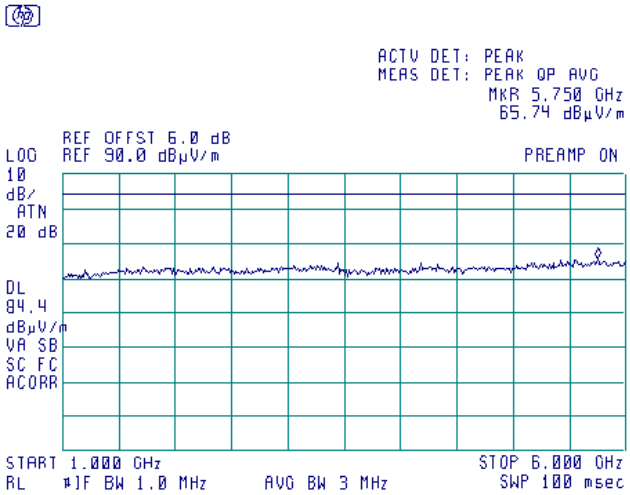
TEST SITE: Semi anechoic chamber
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
CARRIER FREQUENCY: Low



CARRIER FREQUENCY: Mid



CARRIER FREQUENCY: High

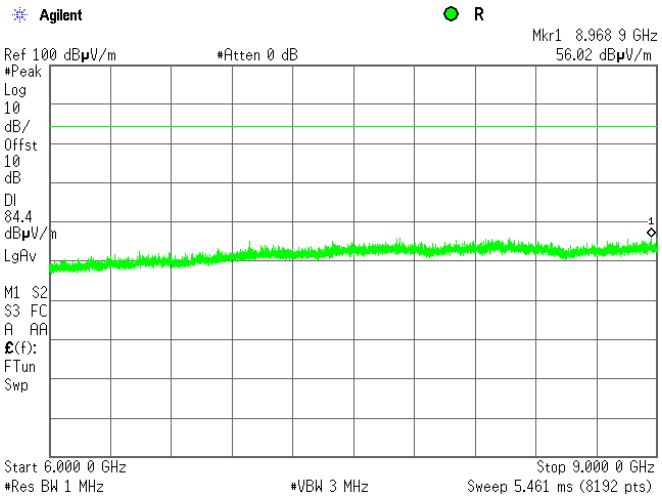


2444 MHz is the Wi-Fi module fundamental frequency

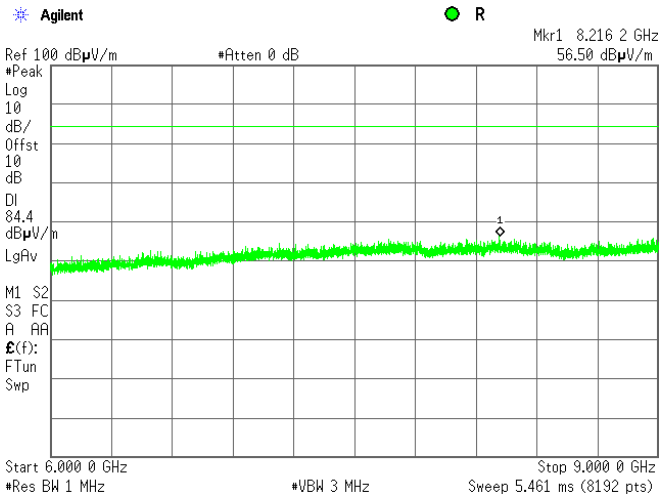
Test specification:	Section 22.917/RSS-132, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 22.917; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Apr-15 - 08-Jul-15		
Temperature: 22 ºC	Air Pressure: 1009 hPa	Relative Humidity: 53 %	Power Supply: 120 VAC
Remarks: 3G module			

Plot 7.2.6 Radiated emission measurements in 6000 – 8960 MHz range

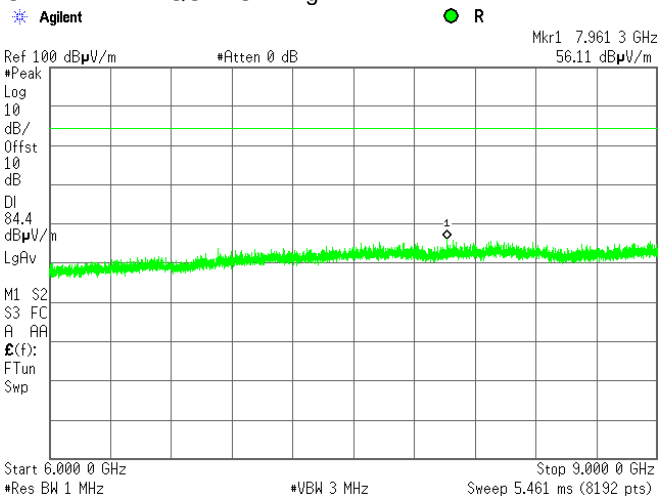
TEST SITE: Semi anechoic chamber
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
CARRIER FREQUENCY: Low



CARRIER FREQUENCY: Mid



CARRIER FREQUENCY: High



Test specification:	Section 22.917/RSS-132, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 22.917; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Apr-15 - 08-Jul-15		
Temperature: 21 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 2G module			

7.3 Radiated spurious emission measurements of 2G module

7.3.1 General

This test was performed to measure radiated spurious emissions from the EUT. Specification test limits are given in Table 7.1.1.

Table 7.3.1 Radiated spurious emission test limits

Frequency, MHz	Attenuation below carrier, dBc	ERP of spurious, dBm	Equivalent field strength limit @ 3m, dB(μV/m)***
0.009 – 10th harmonic*	43+10logP**	-13	84.4

* - Excluding the in band emission within ± 250 % of the authorized bandwidth from the carrier
** - P is transmitter output power in Watts
*** - Equivalent field strength limit was calculated from maximum allowed ERP of spurious as follows: E=sqrt(30×P×1.64)/r, where P is ERP in Watts, 1.64 is numeric gain of ideal dipole and r is antenna to EUT distance in meters

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 7.2.1, energized and the performance check was conducted.

7.3.2.2 The specified frequency range was investigated with antenna connected to spectrum analyzer. 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 in Table 7.1.2 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 7.2.2, energized and the performance check was conducted.

7.3.3.2 The specified frequency range was investigated with antenna connected to spectrum analyzer. To find maximum radiation the turntable was rotated 360^0 and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal, polarizations.

7.3.3.3 The worst test results (the lowest margins) were recorded in Table 7.1.2 and shown in the associated plots.

7.3.4 Test procedure for substitution ERP measurements of spurious

7.3.4.1 The test equipment was set up as shown in Figure 7.1.2 and energized.

7.3.4.2 RF signal generator was set to the frequency of investigated spurious emission and the RF output level was preliminary adjusted to produce the same field strength as it was measured from the EUT.

7.3.4.3 The test antenna height was swept from 1 to 4 m to find maximum emission from substitution antenna and RF signal generator output was fine adjusted to produce the same field strength as it was measured from the EUT.

7.3.4.4 The above procedure was performed in both, horizontal and vertical, polarizations of the test and substitution antennas.

7.3.4.5 The ERP of spurious emissions was calculated as a sum of signal generator output power in dBm and antenna gain in dBd reduced by cable loss in dB.

7.3.4.6 The above procedure was repeated at the rest of investigated frequencies.

7.3.4.7 The worst test results (the lowest margins) were recorded in Table 7.1.3 and shown in the associated plots.

Test specification:	Section 22.917/RSS-132, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 22.917; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Apr-15 - 08-Jul-15		
Temperature: 21 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 2G module			

Figure 7.3.1 Setup for spurious emission field strength measurements in 9 kHz to 30 MHz band

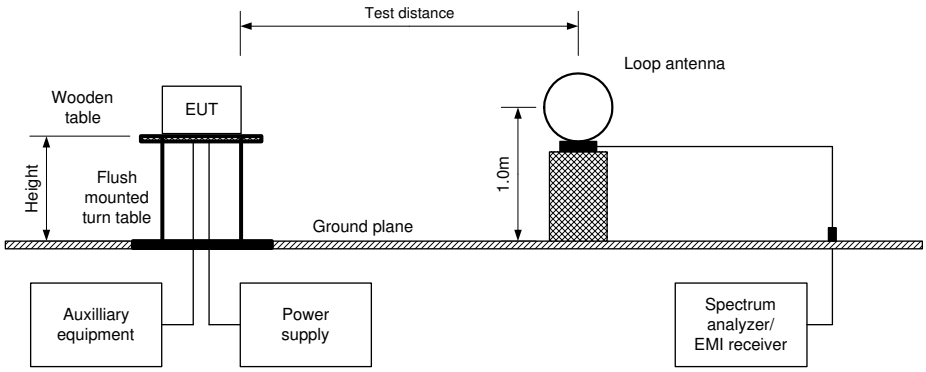
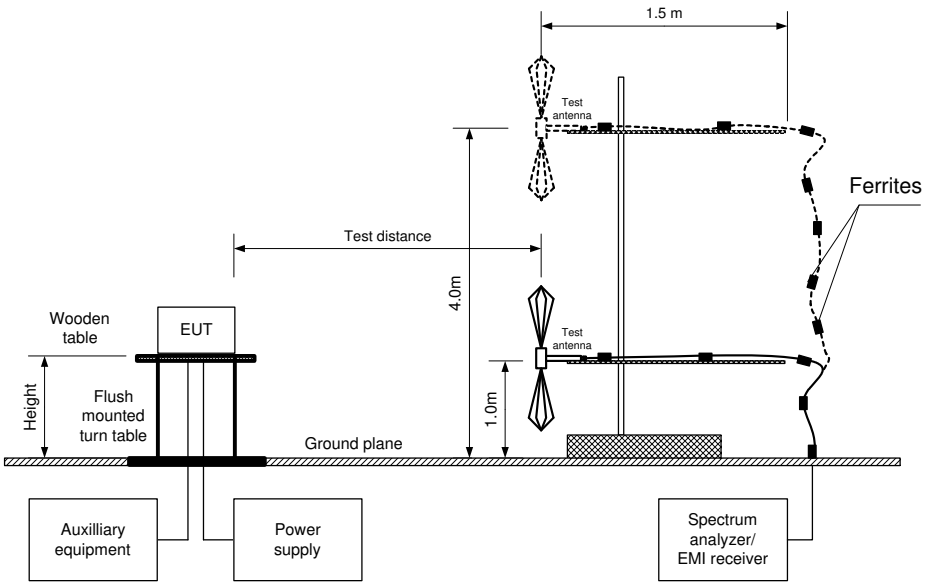
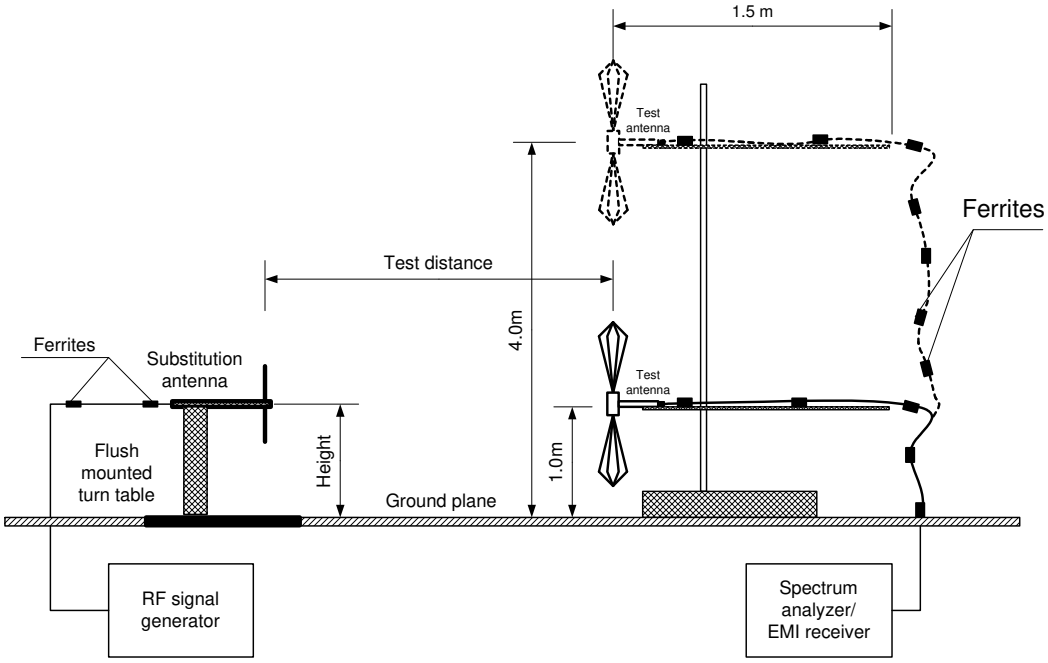


Figure 7.3.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:	Section 22.917/RSS-132, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 22.917; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Apr-15 - 08-Jul-15		
Temperature: 21 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 2G module			

Figure 7.3.3 Setup for substitution ERP measurements of spurious



Test specification:	Section 22.917/RSS-132, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 22.917; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Apr-15 - 08-Jul-15		
Temperature: 21 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 2G module			

Table 7.3.2 Spurious emission field strength test results

ASSIGNED FREQUENCY RANGE: 824-849 MHz
TEST DISTANCE: 3 m
TEST SITE: Semi anechoic chamber
EUT HEIGHT: 0.8 m
INVESTIGATED FREQUENCY RANGE: 0.009 – 9000 MHz
DETECTOR USED: Peak
VIDEO BANDWIDTH: > Resolution bandwidth
TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
Biconilog (30 MHz – 1000 MHz)
Double ridged guide (above 1000 MHz)
MODULATING SIGNAL: PRBS

Frequency, MHz	Field strength, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees
Low carrier frequency 824.2 MHz							
823.978	80.19	84.4	-4.21	120	Horizontal	1.0	157
6594.02	56.69	84.4	-27.71	1000	Horizontal	1.9	143
7417.40	63.75	84.4	-20.65	1000	Horizontal	1.5	160
Mid carrier frequency 836.2 MHz							
6689.57	59.90	84.4	-24.50	1000	Horizontal	1.6	155
7525.43	60.99	84.4	-23.41	1000	Horizontal	1.8	150
High carrier frequency 848.8 MHz							
849.021	85.55	84.4	1.15	120	Horizontal	1.0	157
6790.73	62.40	84.4	-22.00	1000	Horizontal	1.7	140
7638.75	60.26	84.4	-24.14	1000	Horizontal	1.6	144

*- Margin = Field strength of spurious – calculated field strength limit.
**- EUT front panel refers to 0 degrees position of turntable.

Test specification:	Section 22.917/RSS-132, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 22.917; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Apr-15 - 08-Jul-15		
Temperature: 21 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 2G module			

Table 7.3.3 Substitution ERP of spurious test results

ASSIGNED FREQUENCY RANGE: 824-849 MHz
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
SUBSTITUTION ANTENNA HEIGHT: 0.8 m
DETECTOR USED: Peak
VIDEO BANDWIDTH: > Resolution bandwidth
SUBSTITUTION ANTENNA TYPE: Tunable dipole (30 MHz – 1000 MHz)
Double ridged guide (above 1000 MHz)

Frequency, MHz	Field strength, dB(μV/m)	RBW, kHz	Antenna polarization	RF generator output, dBm	Ant gain, dBi	Cable loss, dB	ERP, dBm	Limit, dBm	Margin, dB*	Verdict
Low carrier frequency 824.2 MHz										
823.978	80.19	300	Horizontal	-13.43	0.02	1.83	-15.24	-13.00	-2.24	Pass
High carrier frequency 848.8 MHz										
849.021	84.44	300	Horizontal	-11.57	0.28	1.86	-13.15	-13.00	-0.15	Pass

*- Margin = Spurious emission – specification limit.

Reference numbers of test equipment used

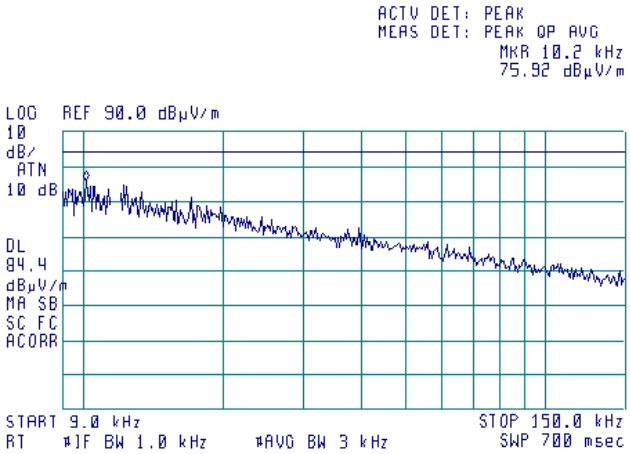
HL 0446	HL 0521	HL 0604	HL 0661	HL 1984	HL 3818	HL 4279	HL 4353
HL 4722	HL 4933						

Full description is given in Appendix A.

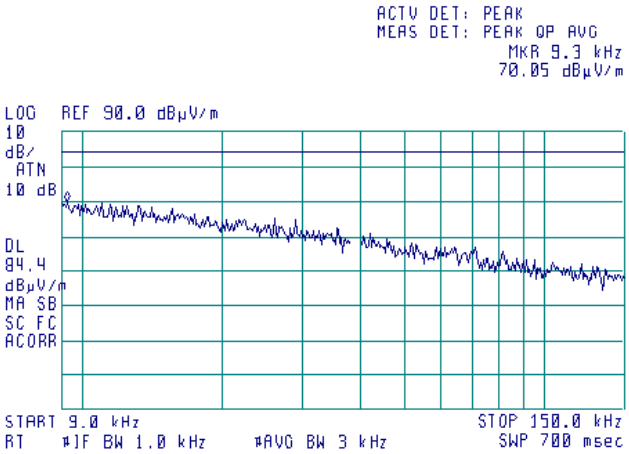
Test specification:	Section 22.917/RSS-132, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 22.917; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Apr-15 - 08-Jul-15		
Temperature: 21 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 2G module			

Plot 7.3.1 Radiated emission measurements in 9 - 150 kHz range

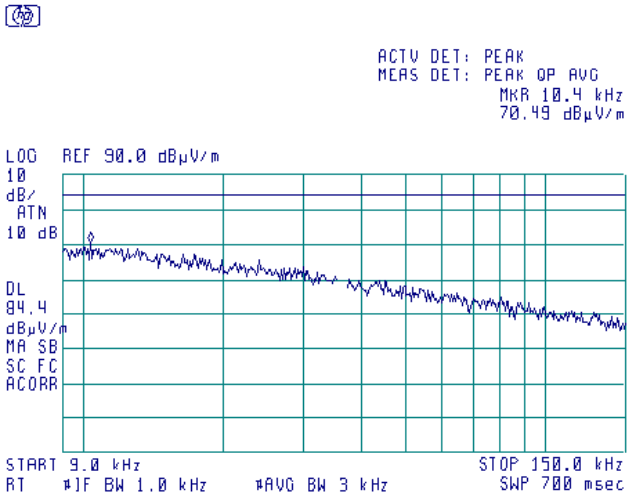
TEST SITE: Semi anechoic chamber
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
CARRIER FREQUENCY: Low



CARRIER FREQUENCY: Mid



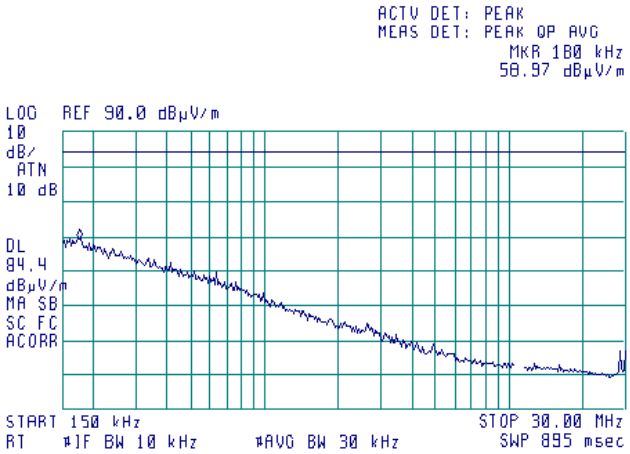
CARRIER FREQUENCY: High



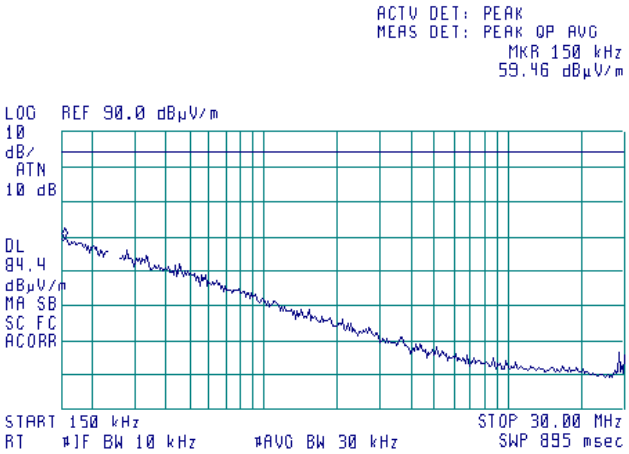
Test specification:	**Section 22.917/RSS-132, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 22.917; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	22-Apr-15 - 08-Jul-15		
Temperature: 21 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 51 %	**Power Supply:** 120 VAC
Remarks: 2G module			

Plot 7.3.2 Radiated emission measurements in 0.15 - 30 MHz range

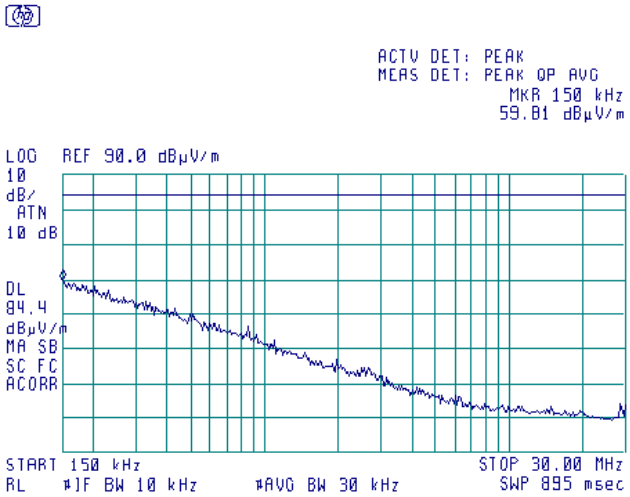
TEST SITE: Semi anechoic chamber
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
CARRIER FREQUENCY: Low



CARRIER FREQUENCY: Mid



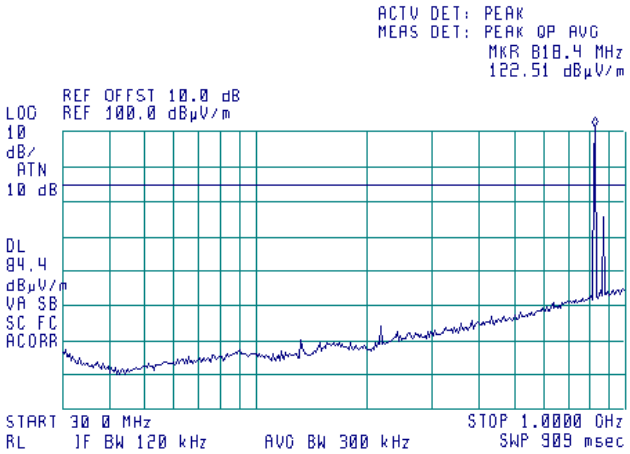
CARRIER FREQUENCY: High

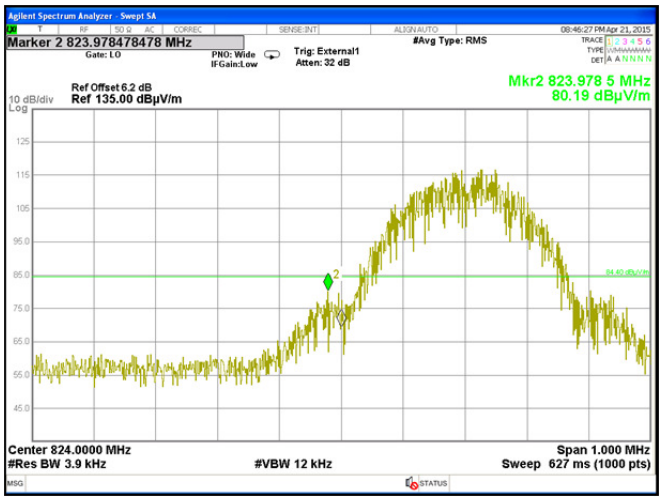


Test specification:	**Section 22.917/RSS-132, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 22.917; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	22-Apr-15 - 08-Jul-15		
Temperature: 21 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 51 %	**Power Supply:** 120 VAC
Remarks: 2G module			

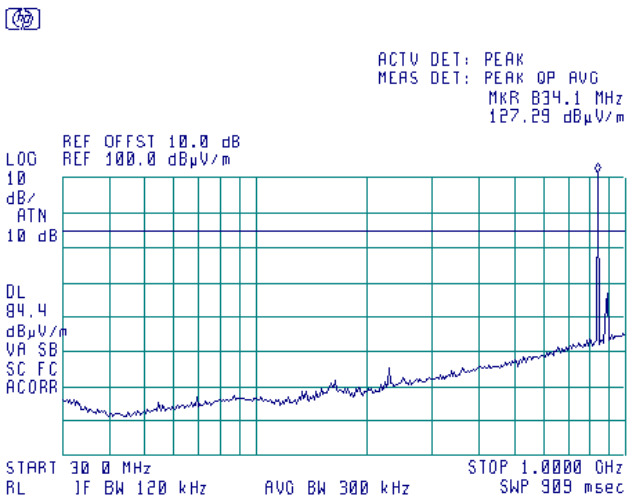
Plot 7.3.3 Radiated emission measurements in 30 - 1000 MHz range

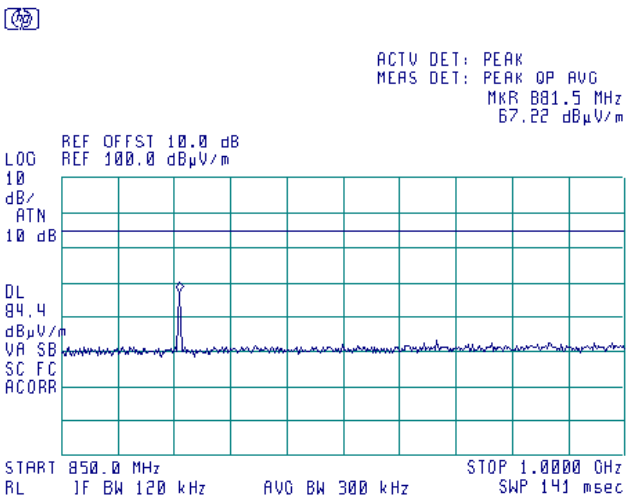
TEST SITE: Semi anechoic chamber
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
CARRIER FREQUENCY: Low





CARRIER FREQUENCY: Mid

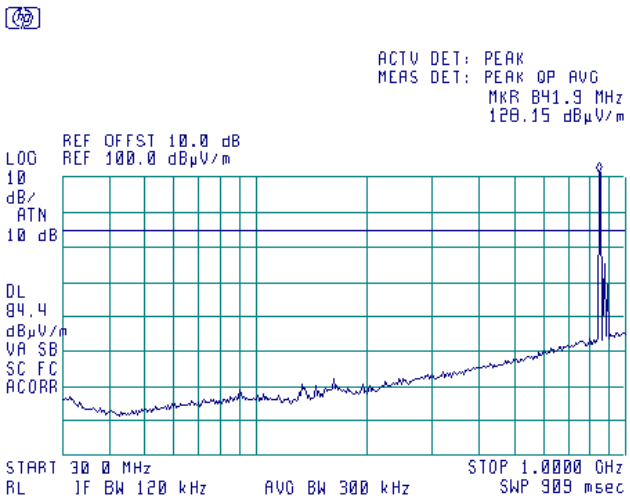




Test specification:	**Section 22.917/RSS-132, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 22.917; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	22-Apr-15 - 08-Jul-15		
Temperature: 21 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 51 %	**Power Supply:** 120 VAC
Remarks: 2G module			

Plot 7.3.4 Radiated emission measurements in 30 - 1000 MHz range

TEST SITE: Semi anechoic chamber
ANTENNA POLARIZATION: Vertical and Horizontal
CARRIER FREQUENCY: High

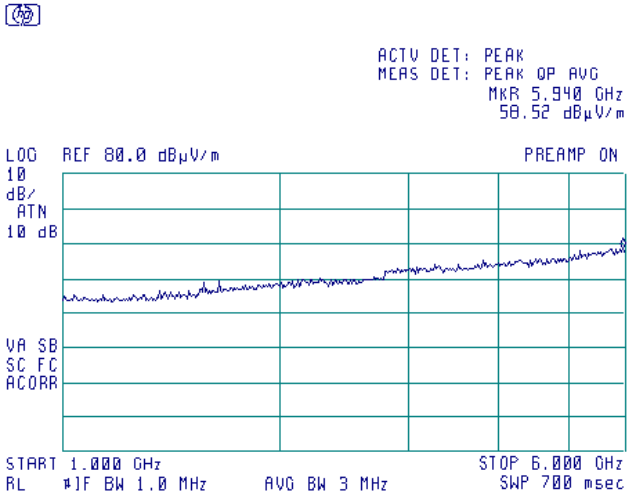


NOTE: 869.5 MHz, 881.5 MHz and 893.9 MHz are the auxiliary base station signals

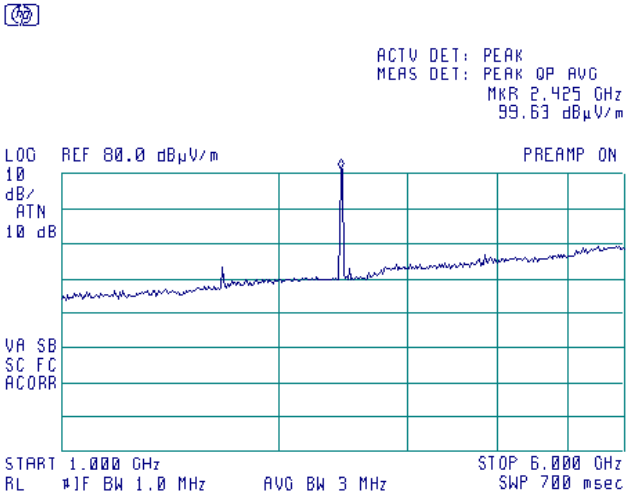
Test specification:	**Section 22.917/RSS-132, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 22.917; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	22-Apr-15 - 08-Jul-15		
Temperature: 21 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 51 %	**Power Supply:** 120 VAC
Remarks: 2G module			

Plot 7.3.5 Radiated emission measurements in 1000 – 6000 MHz range

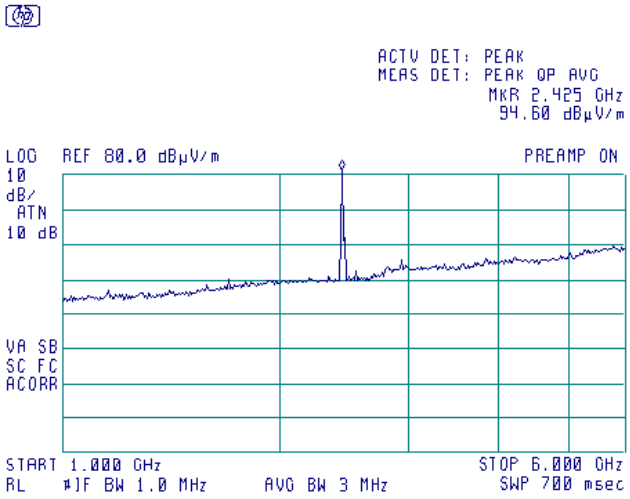
TEST SITE: Semi anechoic chamber
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
CARRIER FREQUENCY: Low



CARRIER FREQUENCY: Mid



CARRIER FREQUENCY: High

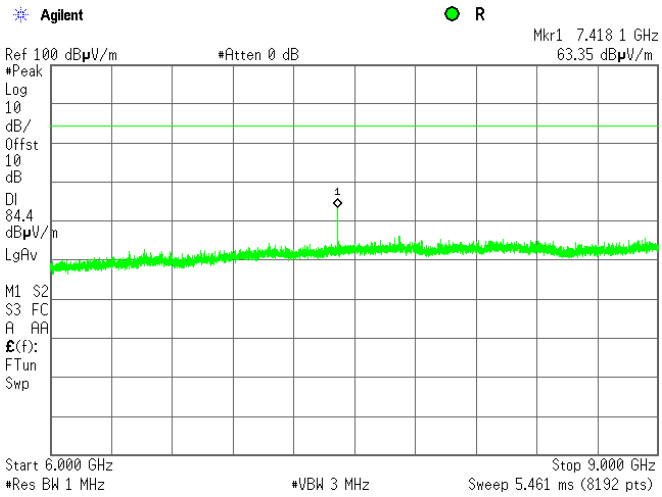


2425 MHz is Wi-Fi module fundamental frequency

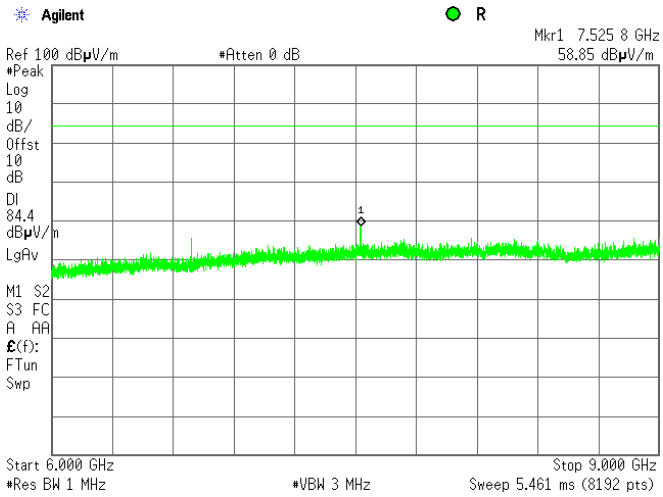
Test specification:	**Section 22.917/RSS-132, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 22.917; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	22-Apr-15 - 08-Jul-15		
Temperature: 21 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 51 %	**Power Supply:** 120 VAC
Remarks: 2G module			

Plot 7.3.6 Radiated emission measurements in 6000 – 8960 MHz range

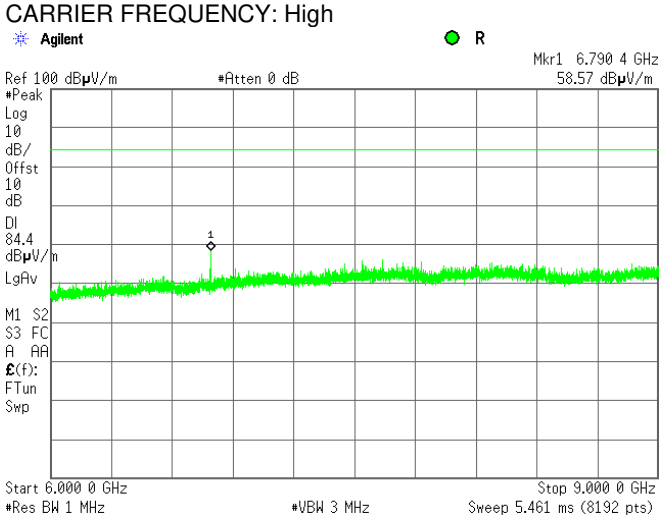
TEST SITE: Semi anechoic chamber
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
CARRIER FREQUENCY: Low



CARRIER FREQUENCY: Mid



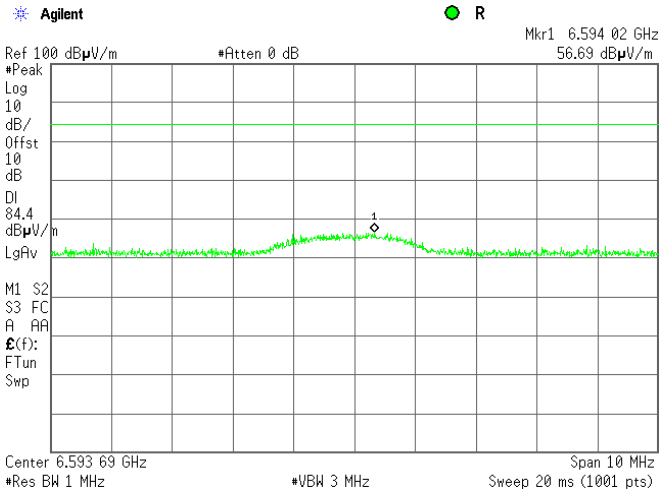
CARRIER FREQUENCY: High



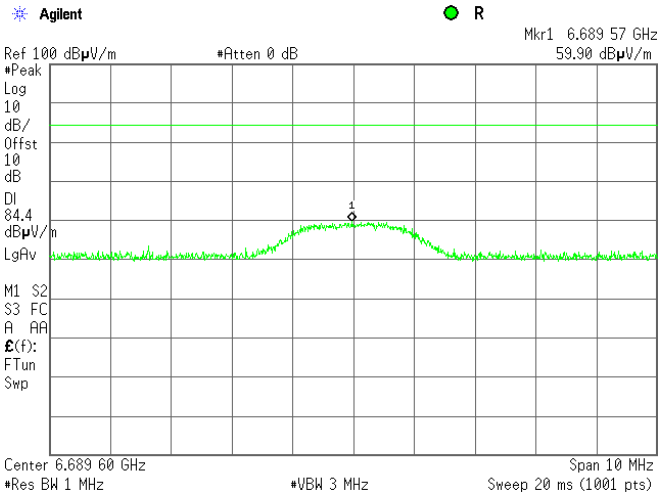
Test specification:	**Section 22.917/RSS-132, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 22.917; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	22-Apr-15 - 08-Jul-15		
Temperature: 21 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 51 %	**Power Supply:** 120 VAC
Remarks: 2G module			

Plot 7.3.7 Radiated emission measurements at the 8th harmonic

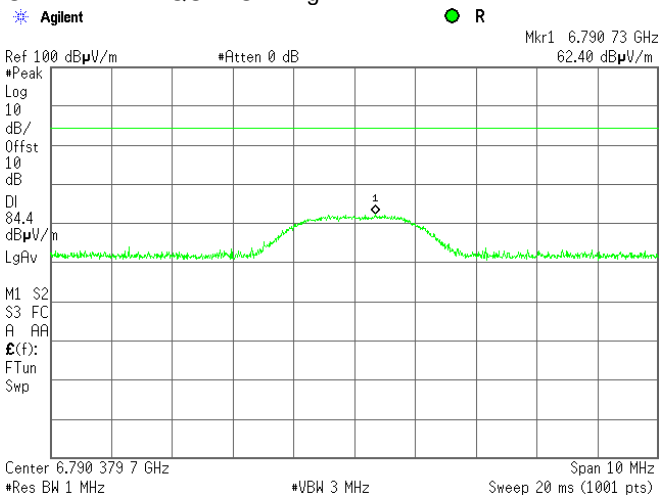
TEST SITE: Semi anechoic chamber
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
CARRIER FREQUENCY: Low



CARRIER FREQUENCY: Mid



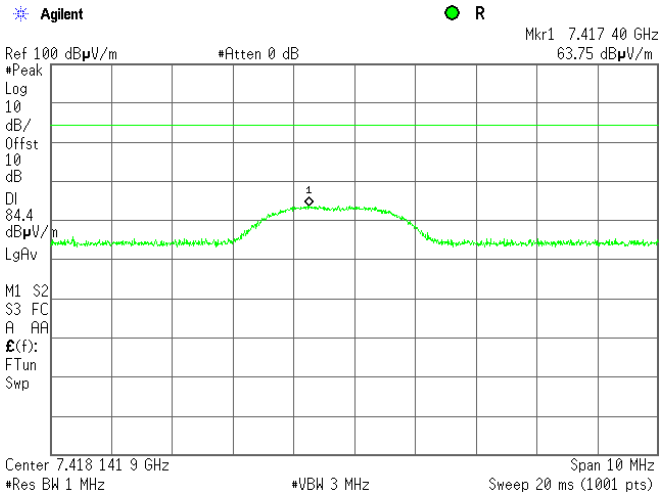
CARRIER FREQUENCY: High



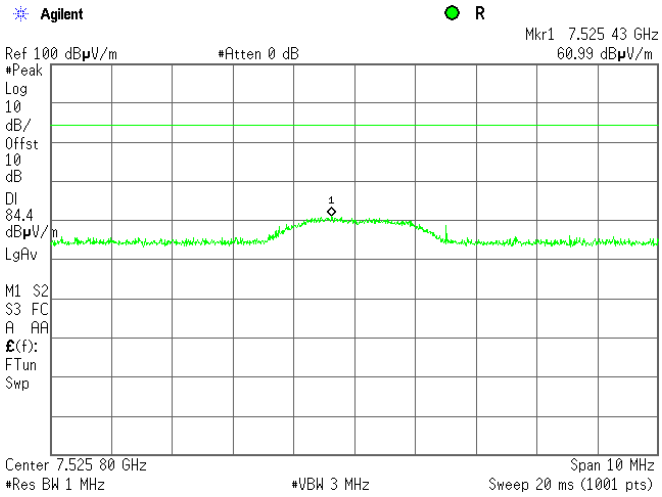
Test specification:	**Section 22.917/RSS-132, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 22.917; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	22-Apr-15 - 08-Jul-15		
Temperature: 21 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 51 %	**Power Supply:** 120 VAC
Remarks: 2G module			

Plot 7.3.8 Radiated emission measurements at the 9th harmonic

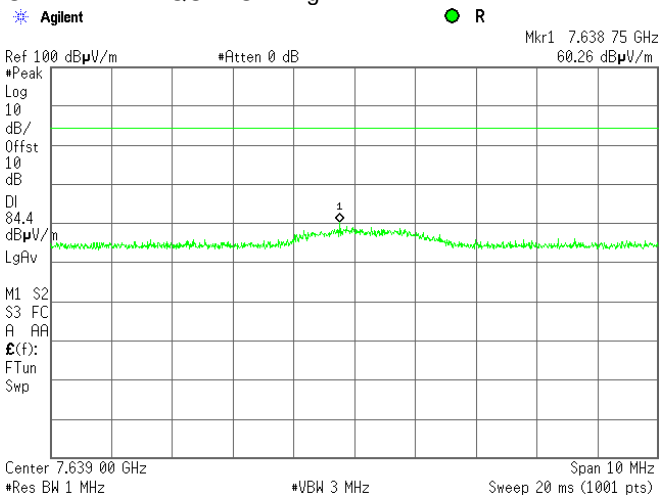
TEST SITE: Semi anechoic chamber
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
CARRIER FREQUENCY: Low



CARRIER FREQUENCY: Mid



CARRIER FREQUENCY: High



Test specification:	Section 24.232/RSS-133/, RF power output		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Jun-15		
Temperature: 21.3 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 2G module/ 3G module			

8 Transmitter tests according to 47CFR part 24 and RSS-133 requirements

8.1 Equivalent isotropically radiated power of carrier

8.1.1 General

This test was performed to measure equivalent isotropically radiated power emanated by transmitter at carrier frequency. Specification test limits are given in Table 7.1.1.

Table 8.1.1 Peak output power limit

Assigned frequency range, MHz	EIRP		Equivalent field strength limit @ 3m, dB(μV/m)*
	W	dBm	
1850 – 1910	2.0	33.00	128.23

* - Equivalent field strength limit was calculated from maximum allowed ERP as follows: E=sqrt(30×P×1.64)/r, where P is ERP in Watts, 1.64 is numeric gain of ideal dipole and r is antenna to EUT distance in meters

8.1.2 Test procedure for field strength measurements

8.1.2.1 The EUT was set up as shown in Figure 7.1.1, energized and the performance check was conducted.

8.1.2.2 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, the measuring antenna height was swept throughout the range, specified in Table 7.1.2, in both vertical and horizontal polarizations.

8.1.2.3 The worst test results (the lowest margins) were recorded in Table 7.1.2 and shown in the associated plots.

8.1.3 Test procedure for substitution ERP measurements

8.1.3.1 The test equipment was set up as shown in Figure 7.1.2 and energized.

8.1.3.2 RF signal generator was set to the EUT carrier frequency and the RF output level was preliminary adjusted to produce the same field strength as it was measured from the EUT.

8.1.3.3 The test antenna height was swept throughout the specified in Table 7.1.2 range to find maximum emission from substitution antenna and RF signal generator output was fine adjusted to produce the same field strength as it was measured from the EUT.

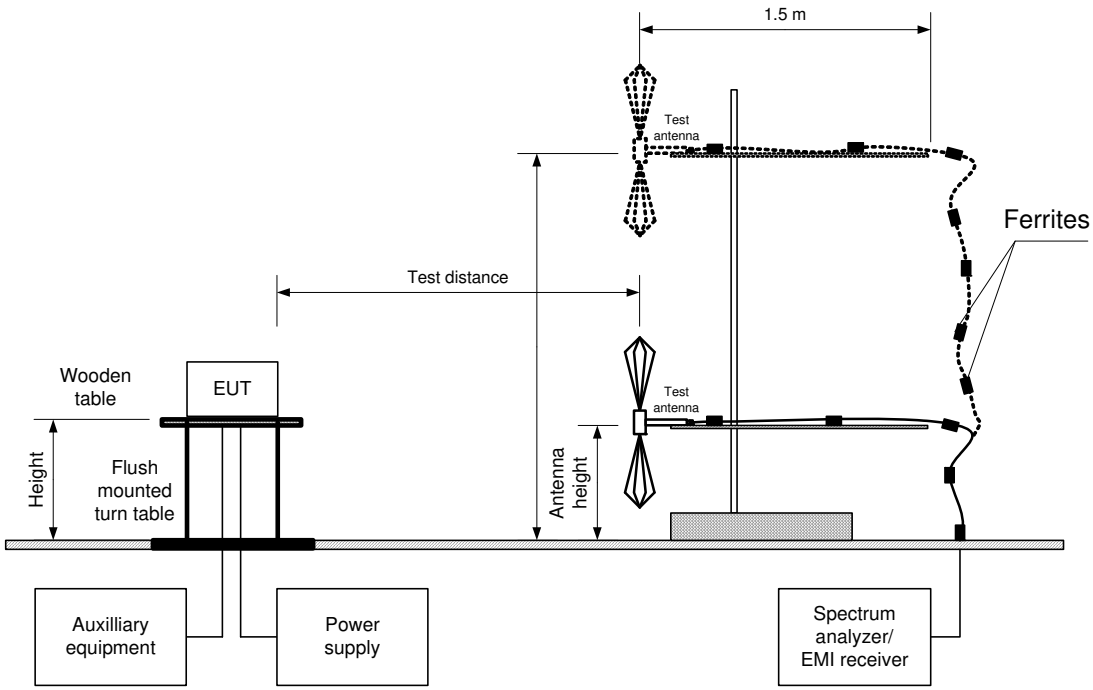
8.1.3.4 The ERP was calculated as a sum of signal generator output power in dBm and antenna gain in dBd reduced by cable loss in dB.

8.1.3.5 The above procedure was performed in both horizontal and vertical polarizations of the test antenna.

8.1.3.6 The worst test results (the lowest margins) were recorded in Table 7.1.3 and shown in the associated plots.

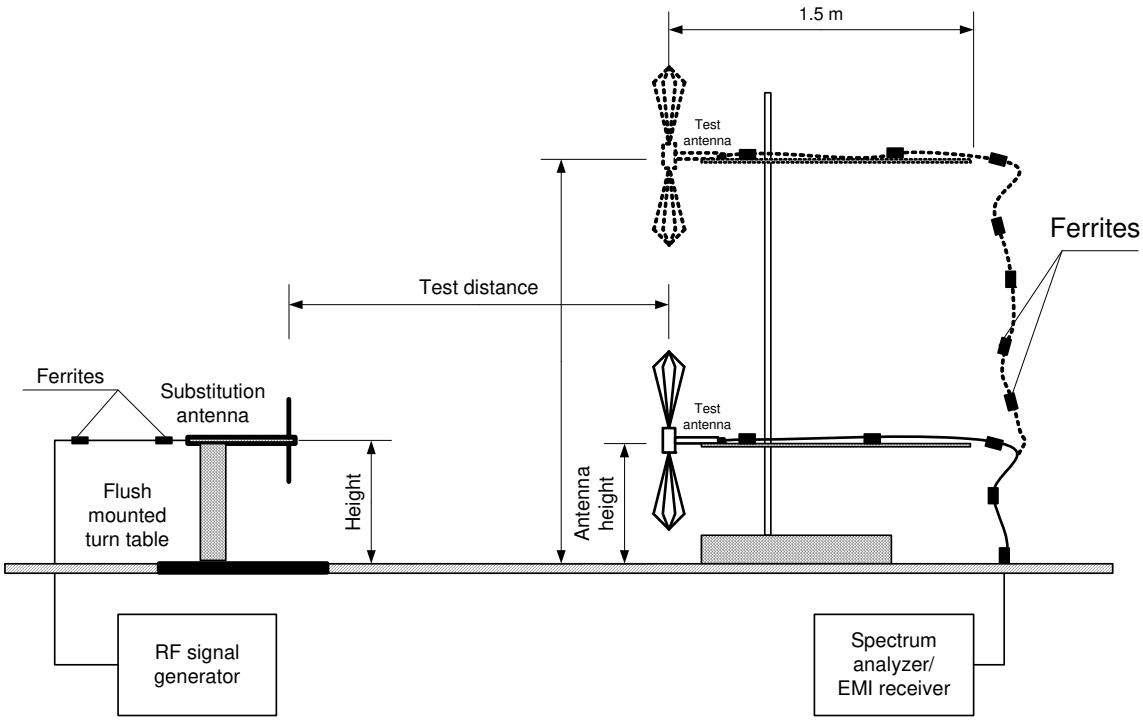
Test specification:	Section 24.232/RSS-133/, RF power output		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Jun-15		
Temperature: 21.3 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 2G module/ 3G module			

Figure 8.1.1 Setup for carrier field strength measurements



Test specification:	Section 24.232/RSS-133/, RF power output		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Jun-15		
Temperature: 21.3 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 2G module/ 3G module			

Figure 8.1.2 Setup for substitution ERP measurements



Test specification:	Section 24.232/RSS-133/, RF power output		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Jun-15		
Temperature: 21.3 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 2G module			

Table 8.1.2 Transmitter carrier field strength of 2G module

ASSIGNED FREQUENCY RANGE: 1850.0 – 1910.0 MHz
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
EUT HEIGHT: 0.8 m
TEST ANTENNA HEIGHTS RANGE: 1.0 – 4.0 m
DETECTOR USED: Peak
VIDEO BANDWIDTH: 3000 kHz
TEST ANTENNA TYPE: Biconical
TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	Field strength, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees
1850.15	121.99	128.3	-6.31	3000	Vert	1.1	281
1850.08	119.11	128.3	-9.19		Hor	1.3	133
1880.05	123.25	128.3	-5.05		Vert	1.8	241
1879.95	120.47	128.3	-7.83		Hor	1.7	232
1909.85	123.73	128.3	-4.57		Vert	1.8	263
1909.73	122.56	128.3	-5.74		Hor	1.0	175

*- Margin = Field strength – calculated field strength limit.
**- EUT front panel refers to 0 degrees position of turntable.

Table 8.1.3 Transmitter carrier EIRP of 2G module

TEST DISTANCE: 3 m
SUBSTITUTION ANTENNA HEIGHT: 0.8 m
TEST ANTENNA HEIGHTS RANGE: 1.0 – 4.0 m
DETECTOR USED: Peak
VIDEO BANDWIDTH: 3000 kHz
SUBSTITUTION ANTENNA TYPE: Tunable dipole

Frequency, MHz	Field strength, dB(μV/m)	RBW, kHz	Antenna polarization	RF generator output, dBm	Ant gain, dBi	Cable loss, dB	EIRP, dBm	Limit, dBm	Margin, dB*	Verdict
1850.15	121.99	3000	Vert	22.84	4.67	1.26	26.25	33.0	-6.75	Pass
1850.08	119.11		Hor	18.91	4.67	1.26	22.32	33.0	-10.68	Pass
1880.05	123.25		Vert	24.1	4.58	1.27	27.41	33.0	-5.59	Pass
1879.95	120.47		Hor	20.27	4.58	1.27	23.58	33.0	-9.42	Pass
1909.85	123.73		Vert	24.58	4.52	1.28	27.82	33.0	-5.18	Pass
1909.73	122.56		Hor	22.36	4.52	1.28	25.60	33.0	-7.40	Pass

*- Margin = ERP – specification limit.

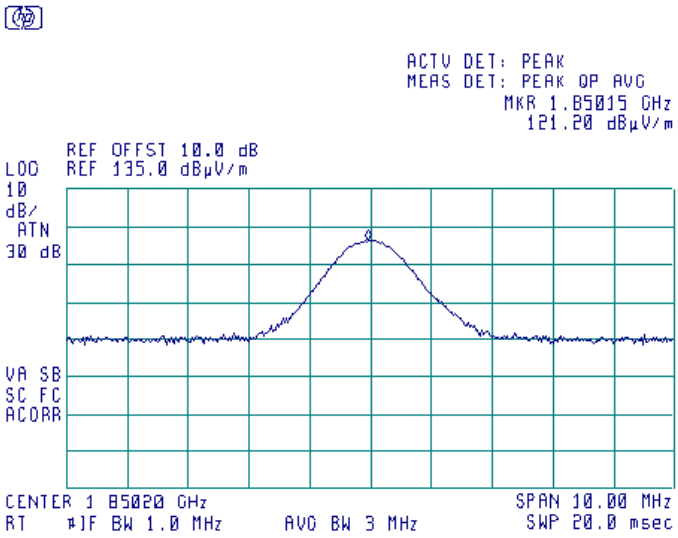
Reference numbers of test equipment used

HL 0661	HL 1984	HL 2871	HL 4114	HL 4353	HL 4722		

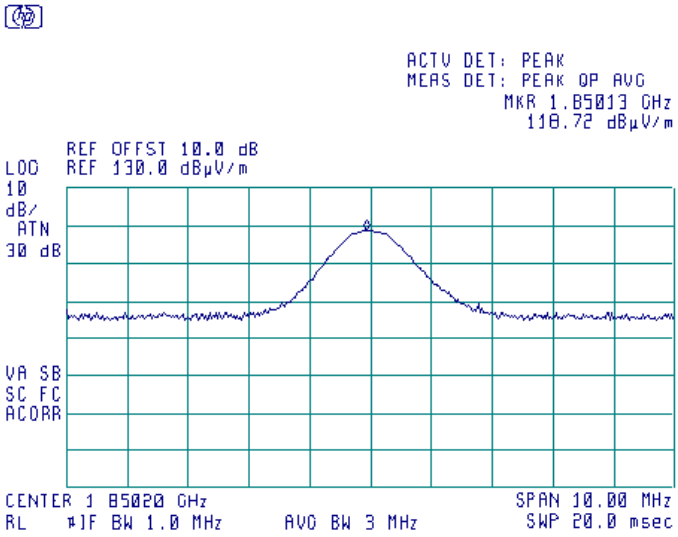
Full description is given in Appendix A.

Test specification:	Section 24.232/RSS-133/, RF power output		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Jun-15		
Temperature: 21.3 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 2G module			

Plot 8.1.1 Transmitter carrier field strength at low frequency in vertical antenna polarization, EUT vertical position

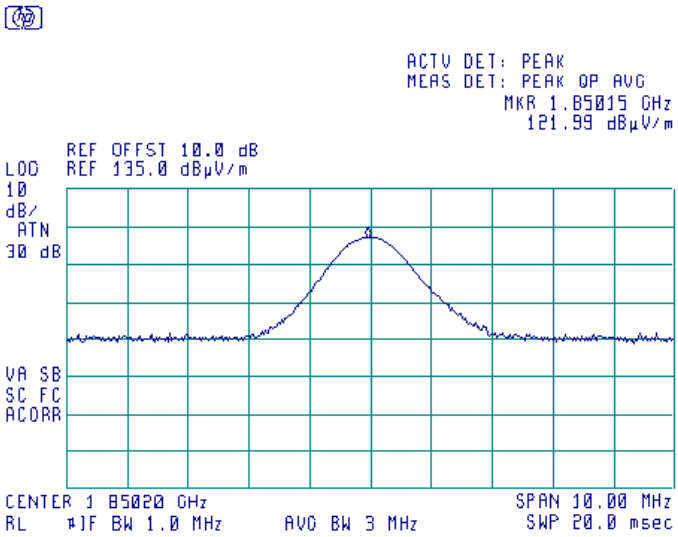


Plot 8.1.2 Transmitter carrier field strength at low frequency in horizontal antenna polarization, EUT vertical position

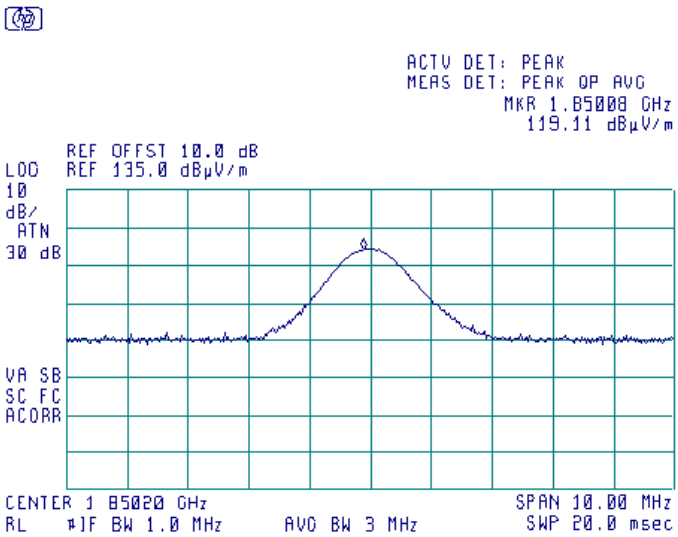


Test specification:	Section 24.232/RSS-133/, RF power output		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Jun-15		
Temperature: 21.3 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 2G module			

Plot 8.1.3 Transmitter carrier field strength at low frequency in vertical antenna polarization, EUT horizontal position

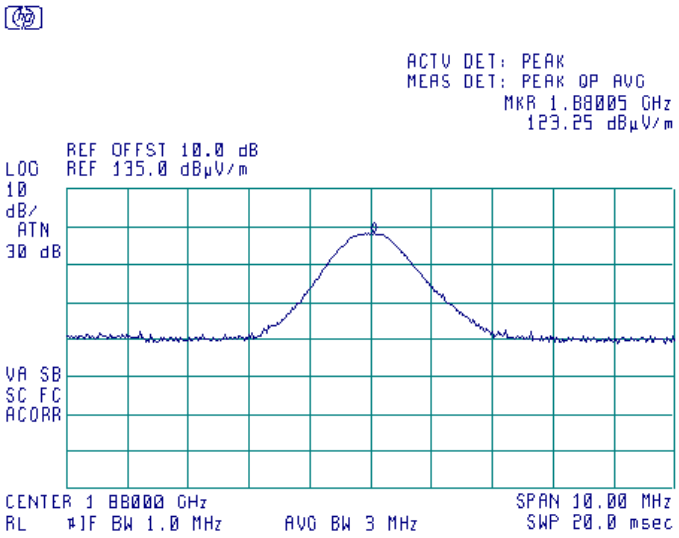


Plot 8.1.4 Transmitter carrier field strength at low frequency in horizontal antenna polarization, EUT horizontal position

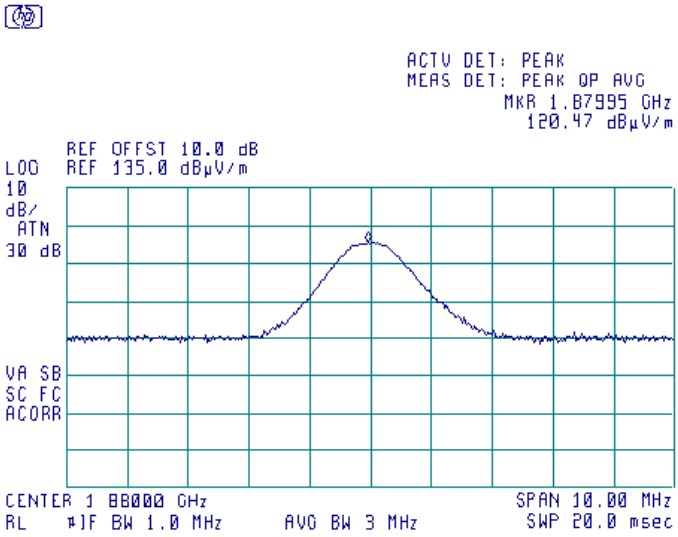


Test specification:	Section 24.232/RSS-133/, RF power output		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Jun-15		
Temperature: 21.3 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 2G module			

Plot 8.1.5 Transmitter carrier field strength at mid frequency in vertical antenna polarization, EUT vertical position

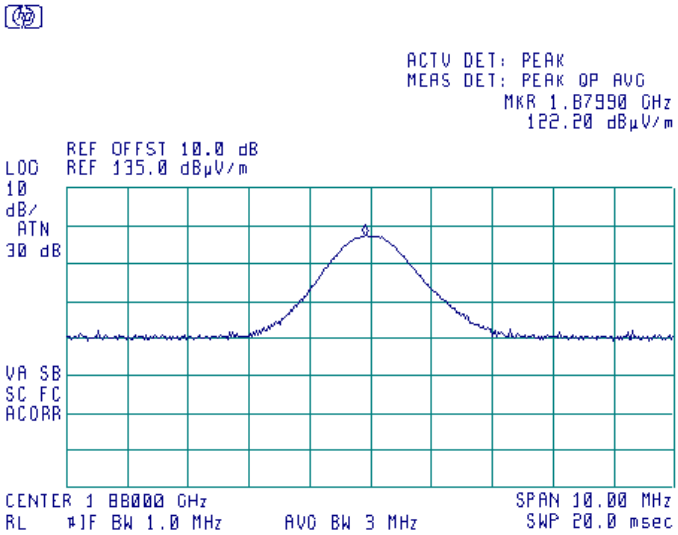


Plot 8.1.6 Transmitter carrier field strength at mid frequency in horizontal antenna polarization, EUT vertical position

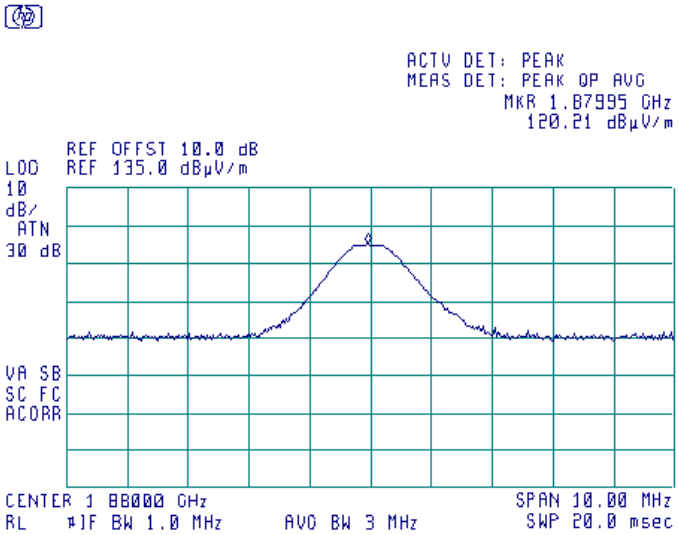


Test specification:	Section 24.232/RSS-133/, RF power output		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Jun-15		
Temperature: 21.3 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 2G module			

Plot 8.1.7 Transmitter carrier field strength at mid frequency in vertical antenna polarization, EUT horizontal position

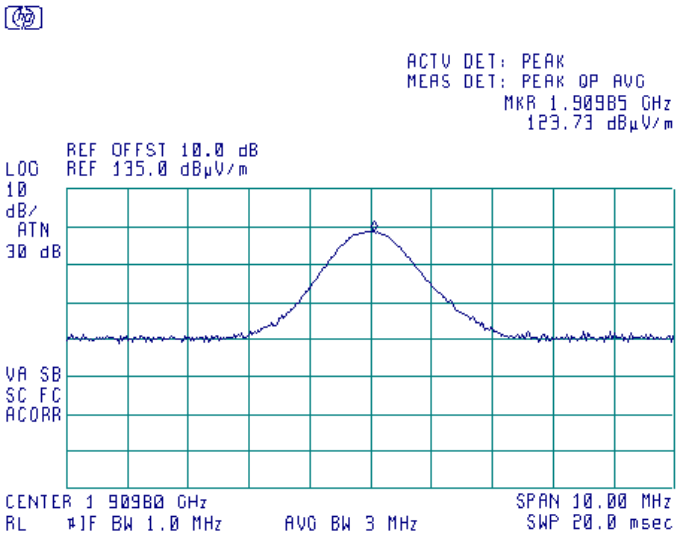


Plot 8.1.8 Transmitter carrier field strength at mid frequency in horizontal antenna polarization, EUT horizontal position

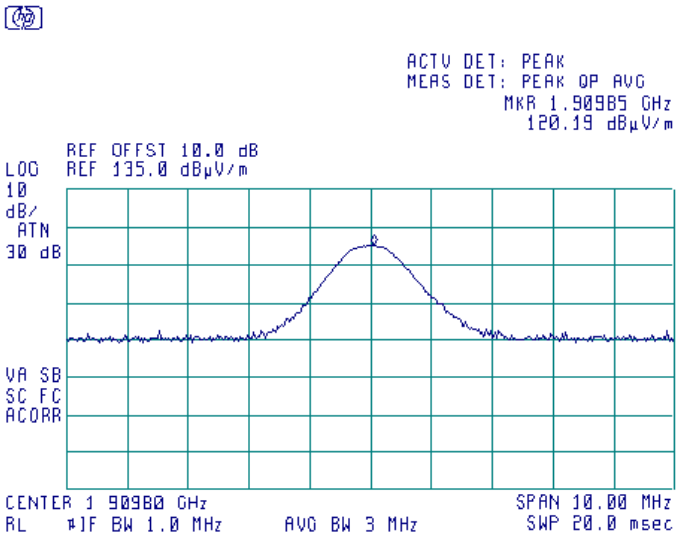


Test specification:	Section 24.232/RSS-133/, RF power output		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Jun-15		
Temperature: 21.3 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 2G module			

Plot 8.1.9 Transmitter carrier field strength at high frequency in vertical antenna polarization, EUT vertical position

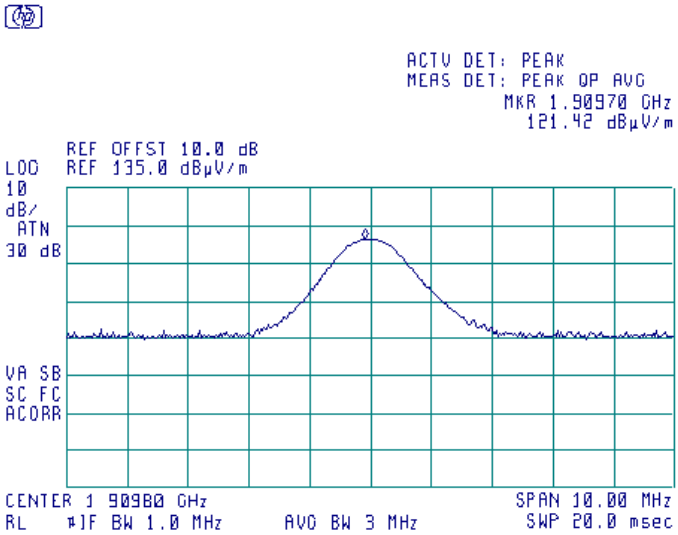


Plot 8.1.10 Transmitter carrier field strength at high frequency in horizontal antenna polarization, EUT vertical position

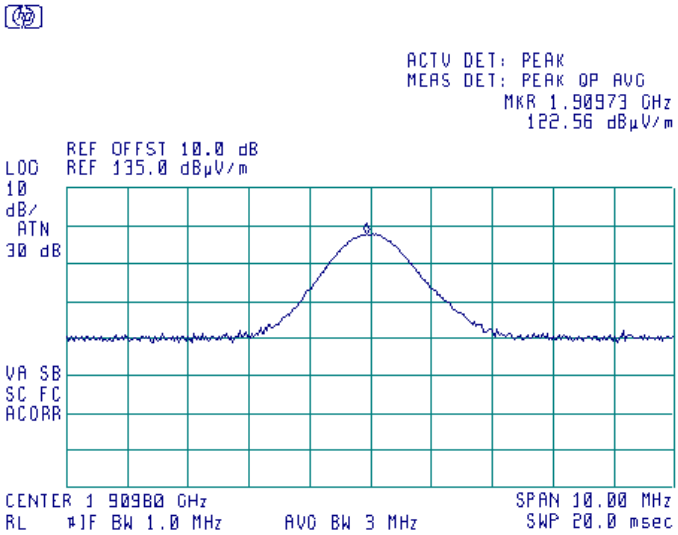


Test specification:	Section 24.232/RSS-133/, RF power output		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Jun-15		
Temperature: 21.3 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 2G module			

Plot 8.1.11 Transmitter carrier field strength at high frequency in vertical antenna polarization, EUT horizontal position



Plot 8.1.12 Transmitter carrier field strength at high frequency in horizontal antenna polarization, EUT horizontal position



Test specification:	Section 24.232/RSS-133/, RF power output		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	09-Jun-15		
Temperature: 21.3 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 3G module			

Table 8.1.4 Transmitter carrier field strength of 3G module

ASSIGNED FREQUENCY RANGE: 1850.0 – 1910.0 MHz
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
EUT HEIGHT: 0.8 m
TEST ANTENNA HEIGHTS RANGE: 1.0 – 4.0 m
DETECTOR USED: Peak
VIDEO BANDWIDTH: 3000 kHz
TEST ANTENNA TYPE: Biconical
TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	Field strength, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees
1851.80	122.18	128.3	-6.12	3000	Vert	1.6	279
1851.95	118.27	128.3	-10.03		Hor	1.7	183
1881.25	120.32	128.3	-7.98		Vert	1.6	278
1879.65	118.56	128.3	-9.74		Hor	1.6	243
1907.40	121.14	128.3	-7.16		Vert	1.5	264
1907.60	118.61	128.3	-9.69		Hor	1.5	224

*- Margin = Field strength – calculated field strength limit.
**- EUT front panel refers to 0 degrees position of turntable.

Table 8.1.5 Transmitter carrier EIRP of 3G module

TEST DISTANCE: 3 m
SUBSTITUTION ANTENNA HEIGHT: 0.8 m
TEST ANTENNA HEIGHTS RANGE: 1.0 – 4.0 m
DETECTOR USED: Peak
VIDEO BANDWIDTH: 3000 kHz
SUBSTITUTION ANTENNA TYPE: Tunable dipole

Frequency, MHz	Field strength, dB(μV/m)	RBW, kHz	Antenna polarization	RF generator output, dBm	Ant gain, dBi	Cable loss, dB	EIRP, dBm	Limit, dBm	Margin, dB*	Verdict
1851.80	122.18	3000	Vert	23.03	4.68	1.26	26.45	33.0	-6.55	Pass
1851.95	118.27		Hor	18.07	4.68	1.26	21.49	33.0	-11.51	Pass
1881.25	120.32		Vert	21.17	4.59	1.27	24.49	33.0	-8.51	Pass
1879.65	118.56		Hor	18.36	4.58	1.27	21.67	33.0	-11.33	Pass
1907.40	121.14		Vert	21.99	4.51	1.28	25.22	33.0	-7.78	Pass
1907.60	118.61		Hor	18.41	4.51	1.28	21.64	33.0	-11.36	Pass

*- Margin = ERP – specification limit.

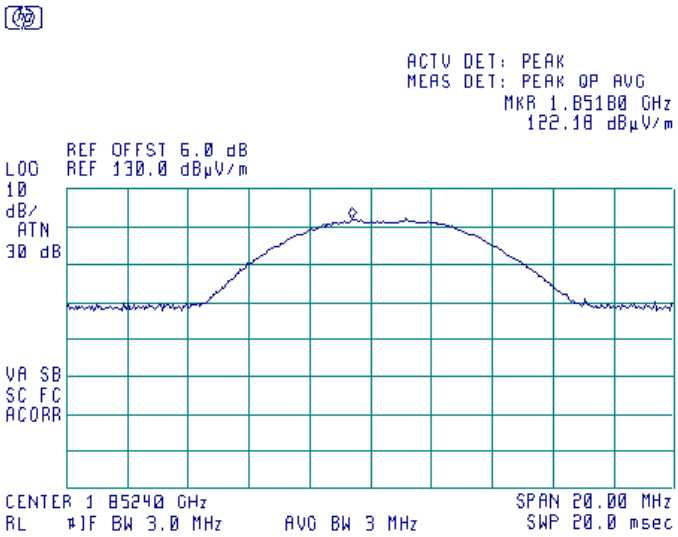
Reference numbers of test equipment used

HL 0661	HL 1984	HL 2871	HL 4114	HL 4353	HL 4722		

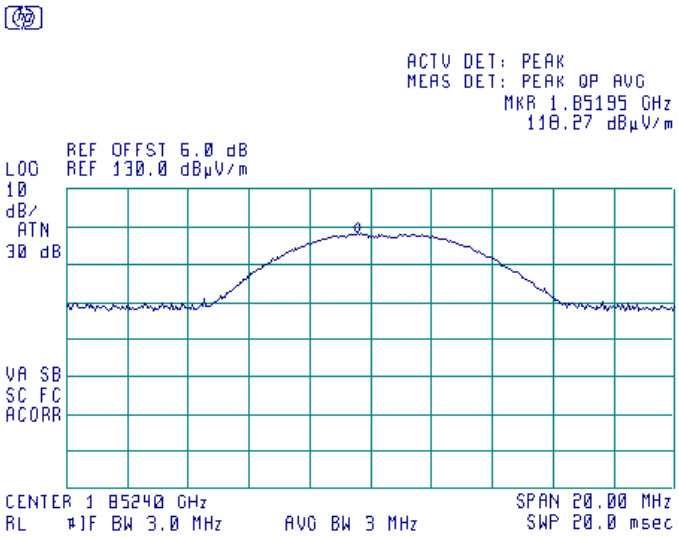
Full description is given in Appendix A.

Test specification:	Section 24.232/RSS-133/, RF power output		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	09-Jun-15		
Temperature: 21.3 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 3G module			

Plot 8.1.13 Transmitter carrier field strength at low frequency in vertical antenna polarization, EUT vertical position

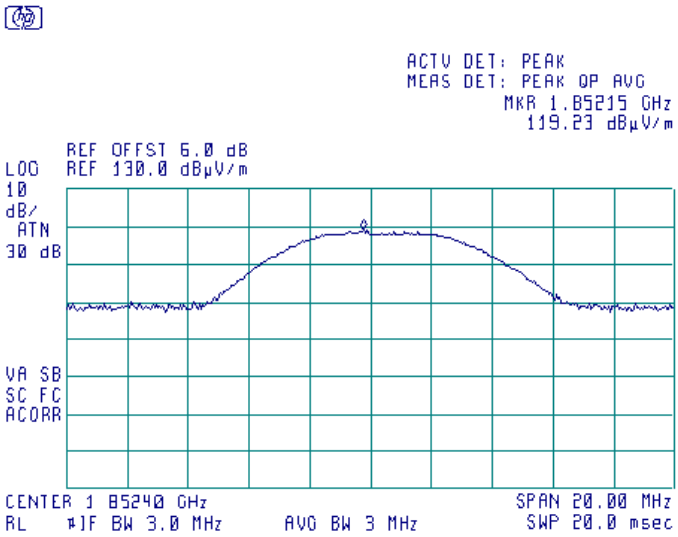


Plot 8.1.14 Transmitter carrier field strength at low frequency in horizontal antenna polarization, EUT vertical position

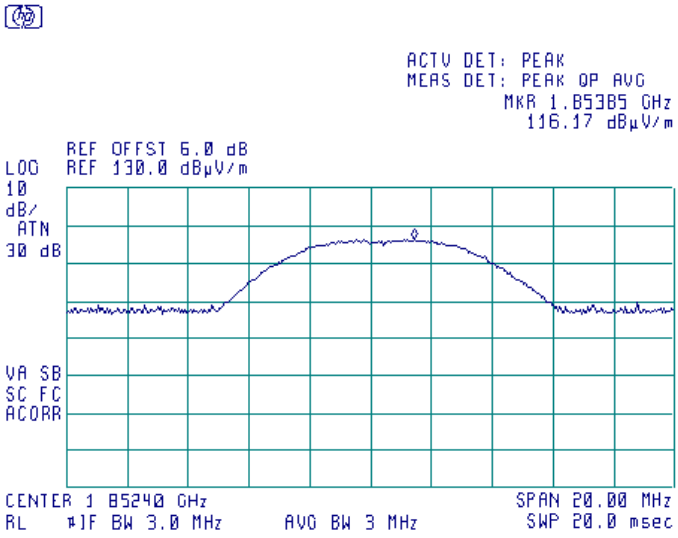


Test specification:	Section 24.232/RSS-133/, RF power output		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	09-Jun-15		
Temperature: 21.3 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 3G module			

Plot 8.1.15 Transmitter carrier field strength at low frequency in vertical antenna polarization, EUT horizontal position

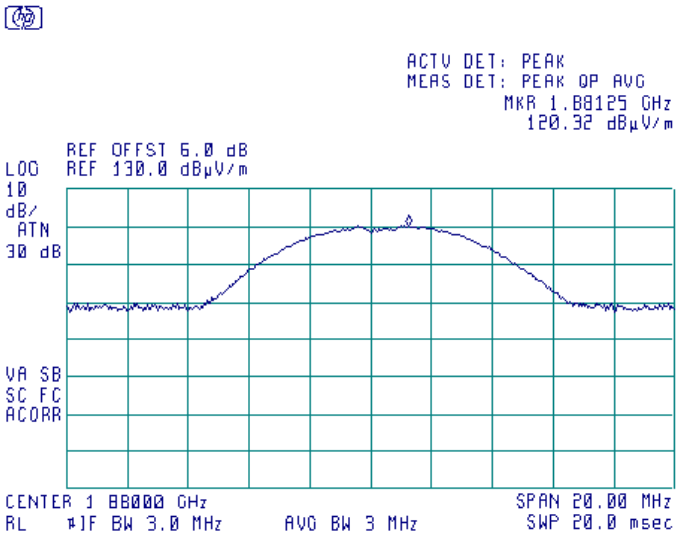


Plot 8.1.16 Transmitter carrier field strength at low frequency in horizontal antenna polarization, EUT horizontal position

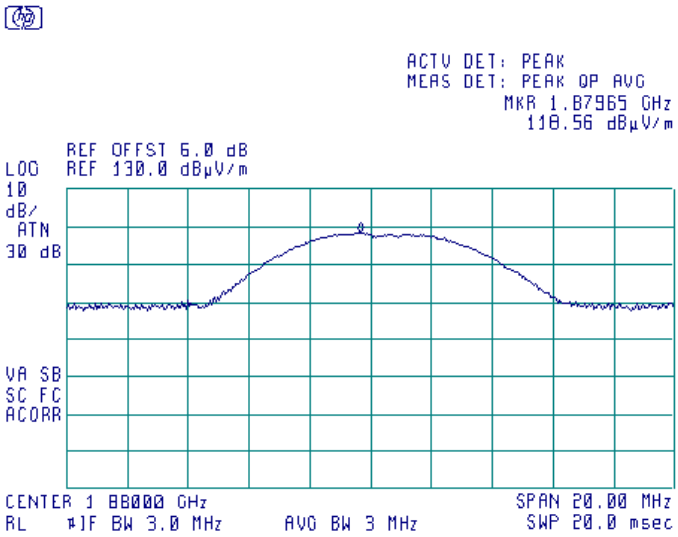


Test specification:	Section 24.232/RSS-133/, RF power output		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	09-Jun-15		
Temperature: 21.3 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 3G module			

Plot 8.1.17 Transmitter carrier field strength at mid frequency in vertical antenna polarization, EUT vertical position

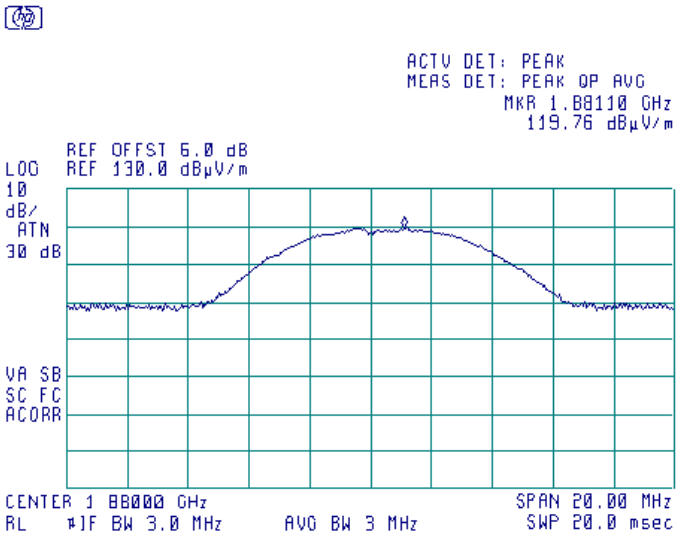


Plot 8.1.18 Transmitter carrier field strength at mid frequency in horizontal antenna polarization, EUT vertical position

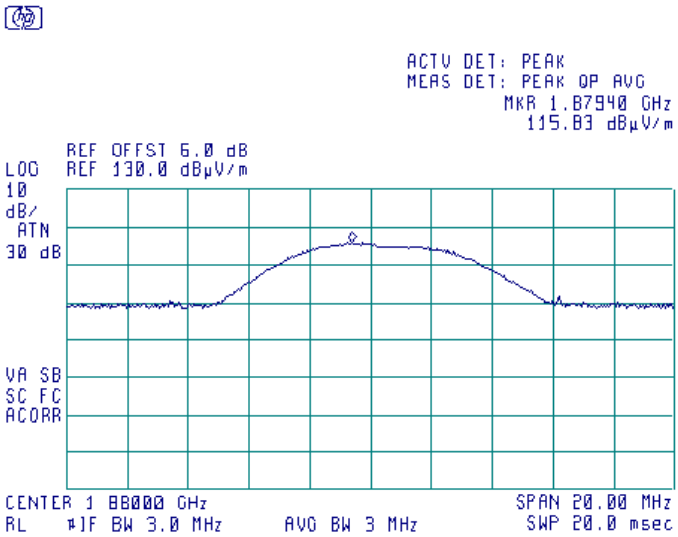


Test specification:	Section 24.232/RSS-133/, RF power output		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	09-Jun-15		
Temperature: 21.3 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 3G module			

Plot 8.1.19 Transmitter carrier field strength at mid frequency in vertical antenna polarization, EUT horizontal position

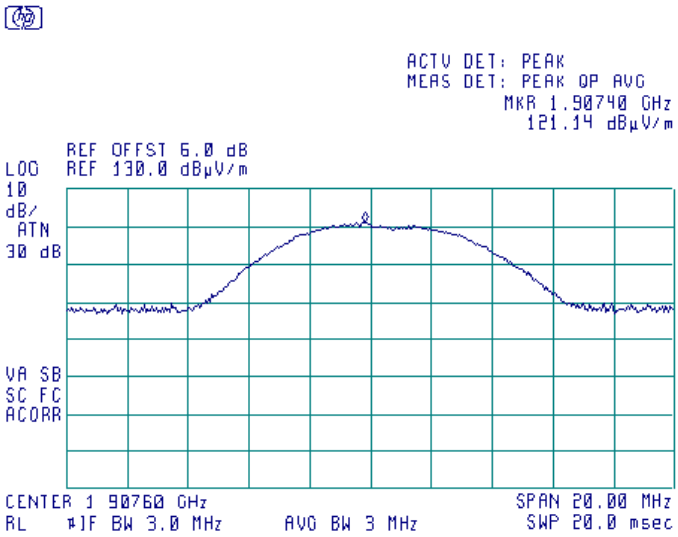


Plot 8.1.20 Transmitter carrier field strength at mid frequency in horizontal antenna polarization, EUT horizontal position

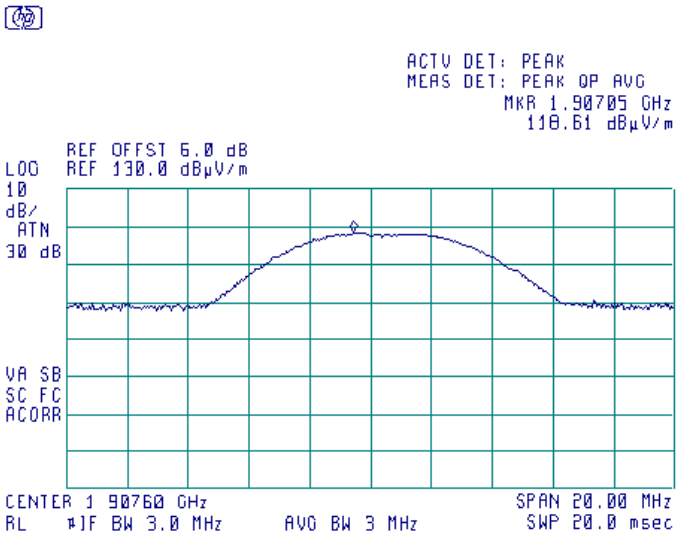


Test specification:	Section 24.232/RSS-133/, RF power output		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	09-Jun-15		
Temperature: 21.3 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 3G module			

Plot 8.1.21 Transmitter carrier field strength at high frequency in vertical antenna polarization, EUT vertical position

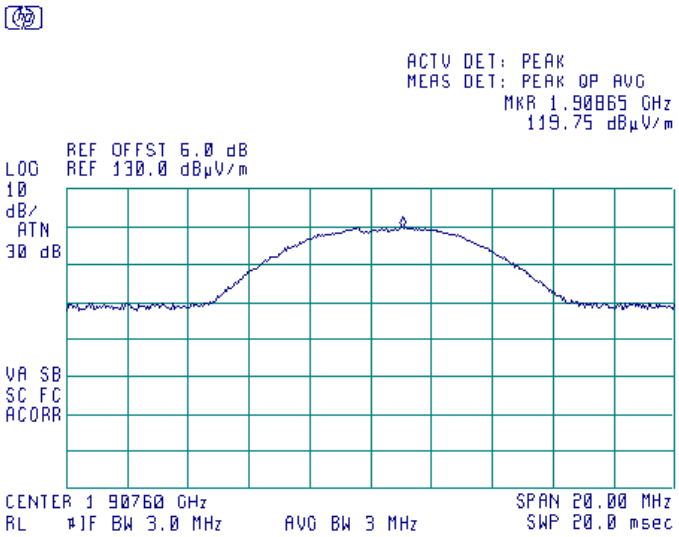


Plot 8.1.22 Transmitter carrier field strength at high frequency in horizontal antenna polarization, EUT vertical position

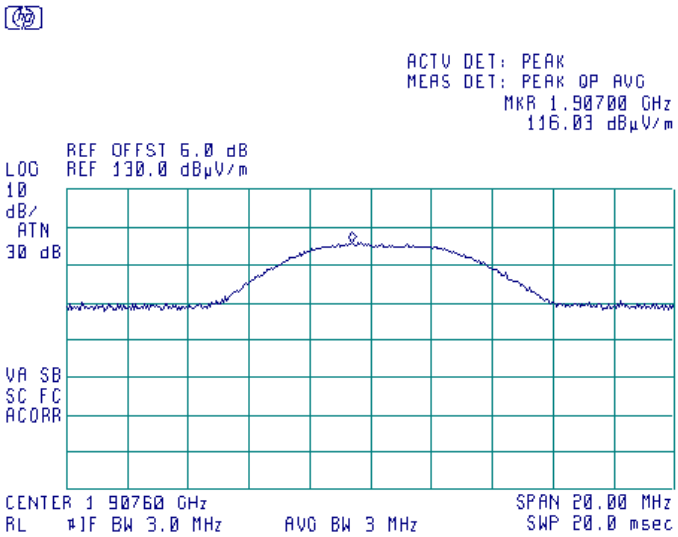


Test specification:	Section 24.232/RSS-133/, RF power output		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	09-Jun-15		
Temperature: 21.3 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 3G module			

Plot 8.1.23 Transmitter carrier field strength at high frequency in vertical antenna polarization, EUT horizontal position



Plot 8.1.24 Transmitter carrier field strength at high frequency in horizontal antenna polarization, EUT horizontal position



Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	09-Jun-15 - 08-Jul-15		
Temperature: 22 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 3G module			

8.2 Radiated spurious emission measurements of 3G module

8.2.1 General

This test was performed to measure radiated spurious emissions from the EUT. Specification test limits are given in Table 8.2.1.

Table 8.2.1 Radiated spurious emission test limits

Frequency, MHz	Attenuation below carrier, dBc	EIRP of spurious, dBm	Equivalent field strength limit @ 3m, dB(μV/m)***
0.009 – 10th harmonic*	43+10logP**	-13	82.25

* - Excluding the in band emission within ± 250 % of the authorized bandwidth from the carrier
** - P is transmitter output power in Watts
*** - Equivalent field strength limit was calculated from maximum allowed ERP of spurious as follows: E=sqrt(30×P×1.64)/r, where P is ERP in Watts, 1.64 is numeric gain of ideal dipole and r is antenna to EUT distance in meters

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

8.2.2.1 The EUT was set up as shown in Figure 8.2.1, energized and the performance check was conducted.

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

8.2.2.3 The worst test results (the lowest margins) were recorded in Table 8.2.2 and shown in the associated plots.

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

8.2.3.1 The EUT was set up as shown in Figure 8.2.2, energized and the performance check was conducted.

8.2.3.2 The specified frequency range was investigated with antenna connected to spectrum analyzer. To find maximum radiation the turntable was rotated 360^0 and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal, polarizations.

8.2.3.3 The worst test results (the lowest margins) were recorded in Table 8.2.2 and shown in the associated plots.

Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	09-Jun-15 - 08-Jul-15		
Temperature: 22 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 3G module			

Figure 8.2.1 Setup for spurious emission field strength measurements in 9 kHz to 30 MHz band

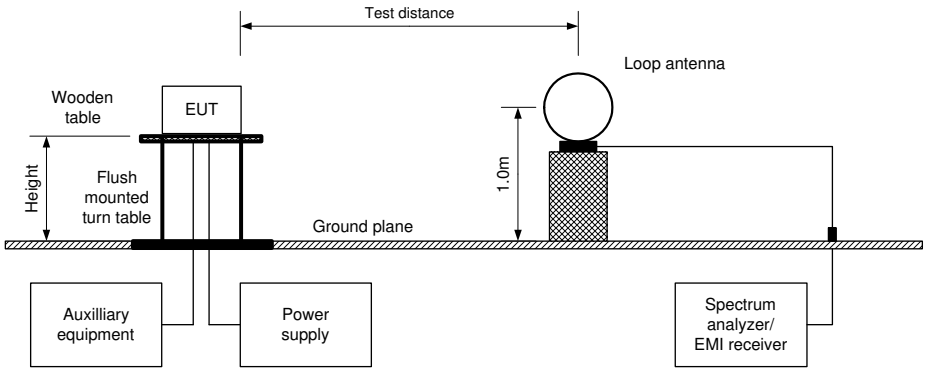
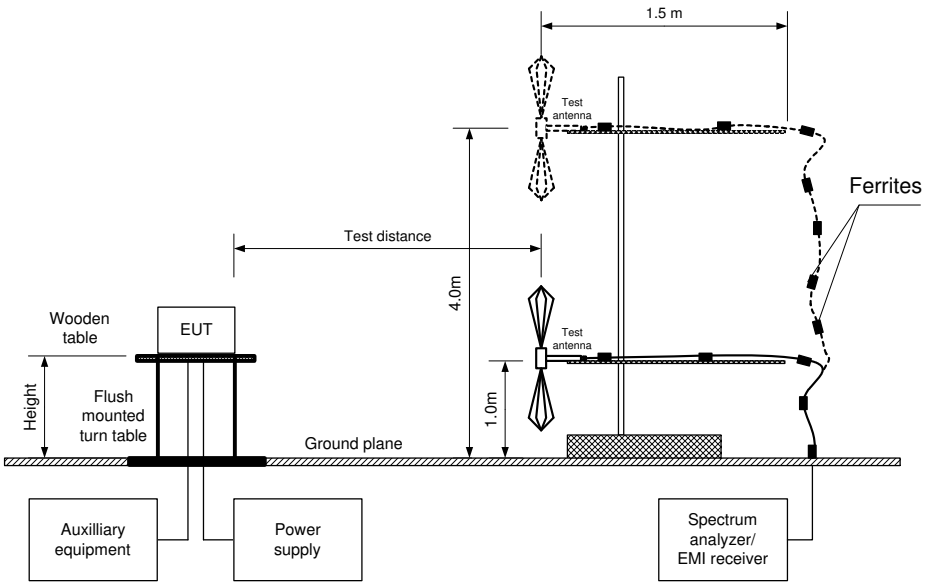


Figure 8.2.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:	**Section 24.238, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	09-Jun-15 - 08-Jul-15		
Temperature: 22 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 51 %	**Power Supply:** 120 VAC
Remarks: 3G module			

Table 8.2.2 Spurious emission field strength test results

ASSIGNED FREQUENCY RANGE: 1850-1910 MHz
TEST DISTANCE: 3 m
TEST SITE: Semi anechoic chamber
EUT HEIGHT: 0.8 m
INVESTIGATED FREQUENCY RANGE: 0.009 – 19000 MHz
DETECTOR USED: Peak
VIDEO BANDWIDTH: > Resolution bandwidth
TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
Biconilog (30 MHz – 1000 MHz)
Double ridged guide (above 1000 MHz)
MODULATING SIGNAL: PRBS

Frequency, MHz	**Field strength, dB(μV/m)**	**Limit, dB(μV/m)**	**Margin, dB***	**RBW, kHz**	**Antenna polarization**	**Antenna height, m**	**Turn-table position**, degrees**
Low carrier frequency 1852.4 MHz							
No emissions except fundamental carriers were found.							
Mid carrier frequency 1880 MHz							
No emissions except fundamental carriers were found.							
High carrier frequency 1907.6 MHz							
No emissions except fundamental carriers were found.							

Verdict: Pass

*- Margin = Field strength of spurious – calculated field strength limit.
**- EUT front panel refers to 0 degrees position of turntable.

Reference numbers of test equipment used

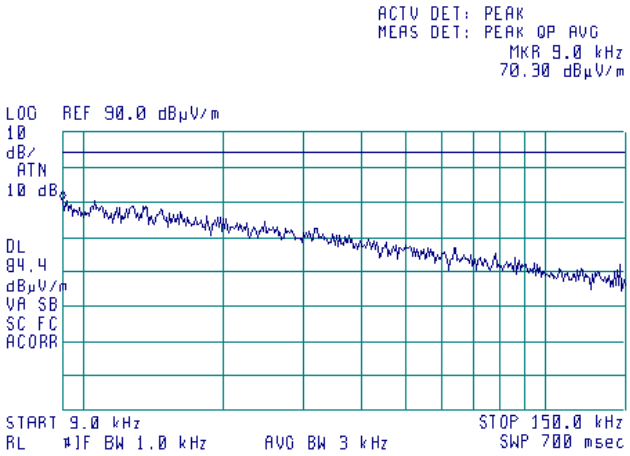
HL 0446	HL 0521	HL 1984	HL 3818	HL 4353	HL 4722	HL 4856	HL 4933

Full description is given in Appendix A.

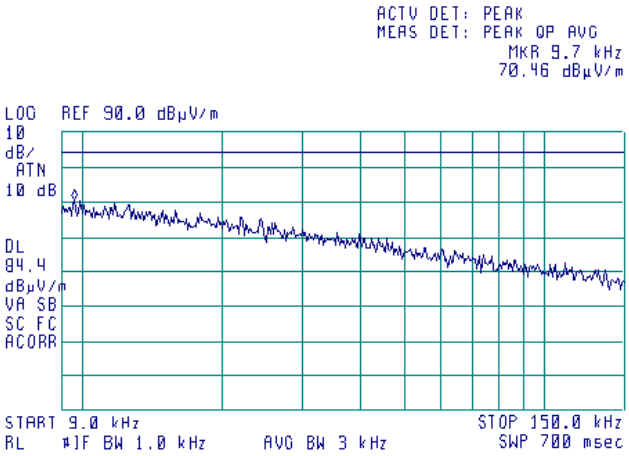
Test specification:	**Section 24.238, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	09-Jun-15 - 08-Jul-15		
Temperature: 22 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 51 %	**Power Supply:** 120 VAC
Remarks: 3G module			

Plot 8.2.1 Radiated emission measurements in 9 - 150 kHz range

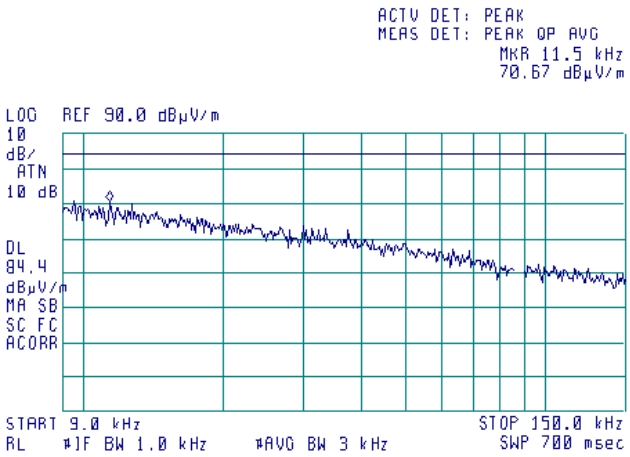
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
CARRIER FREQUENCY: Low



CARRIER FREQUENCY: Mid



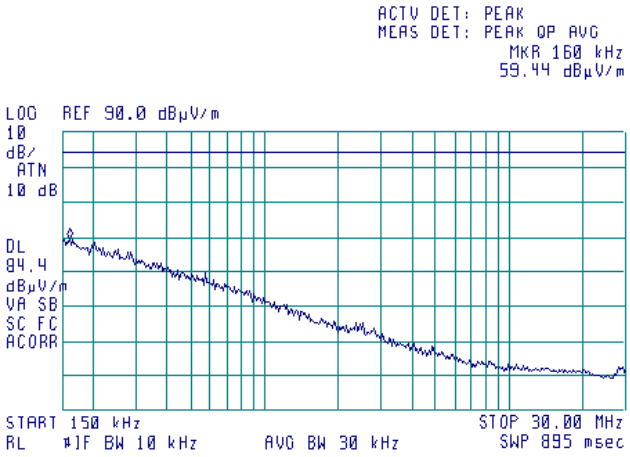
CARRIER FREQUENCY: High



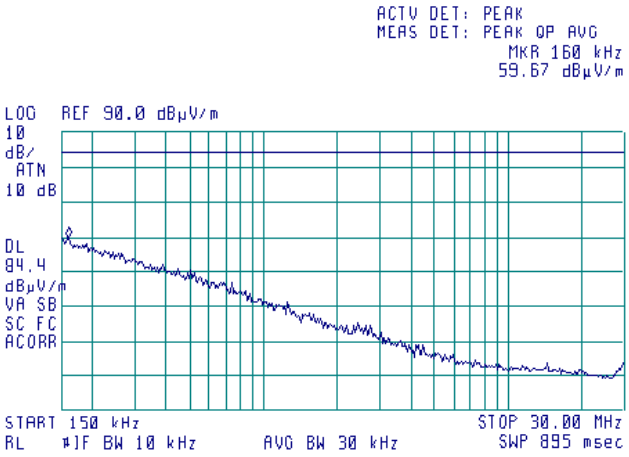
Test specification:	**Section 24.238, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	09-Jun-15 - 08-Jul-15		
Temperature: 22 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 51 %	**Power Supply:** 120 VAC
Remarks: 3G module			

Plot 8.2.2 Radiated emission measurements in 0.15 - 30 MHz range

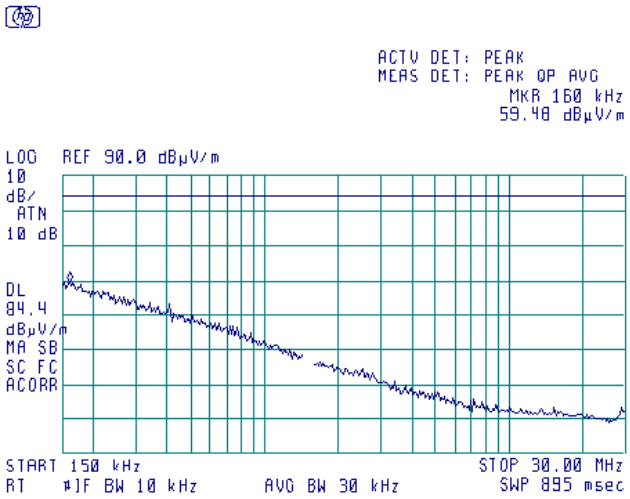
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
CARRIER FREQUENCY: Low



CARRIER FREQUENCY: Mid



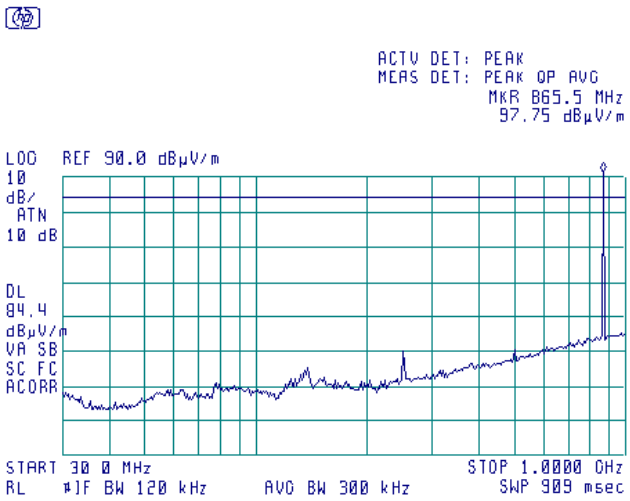
CARRIER FREQUENCY: High



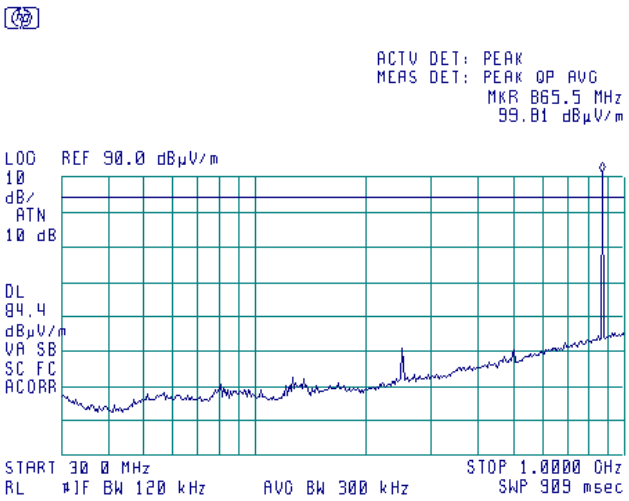
Test specification:	**Section 24.238, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	09-Jun-15 - 08-Jul-15		
Temperature: 22 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 51 %	**Power Supply:** 120 VAC
Remarks: 3G module			

Plot 8.2.3 Radiated emission measurements in 30 - 1000 MHz range

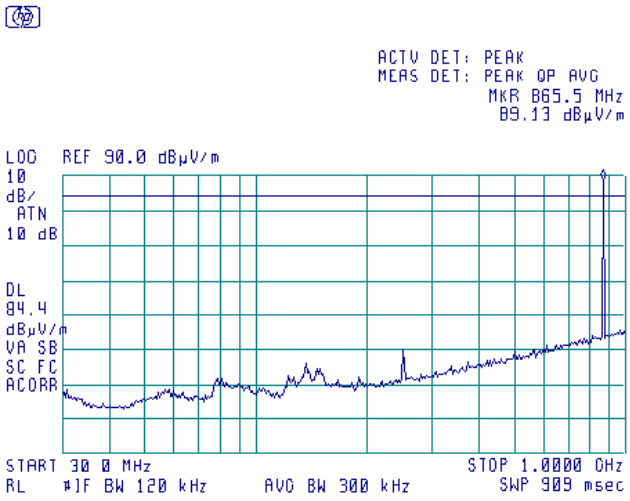
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
CARRIER FREQUENCY: Low



CARRIER FREQUENCY: Mid



CARRIER FREQUENCY: High

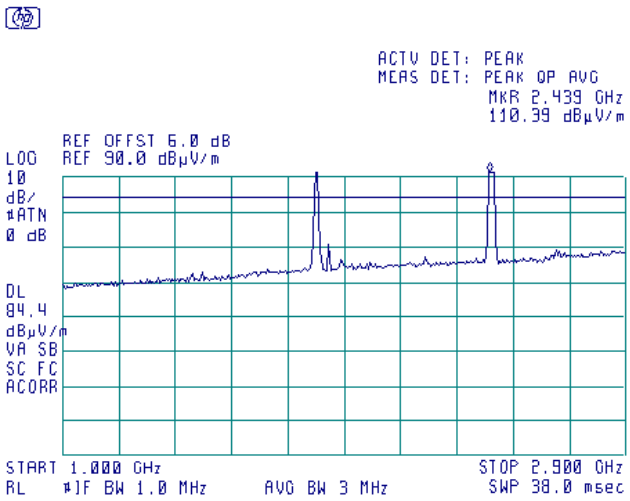


NOTE: 868 MHz carrier from RF module PG2

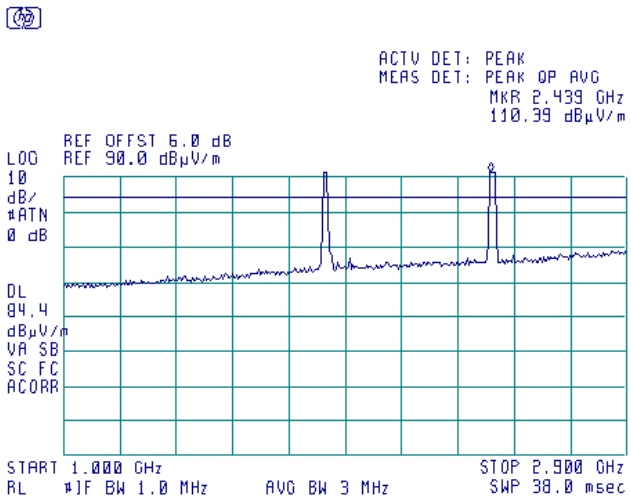
Test specification:	**Section 24.238, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	09-Jun-15 - 08-Jul-15		
Temperature: 22 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 51 %	**Power Supply:** 120 VAC
Remarks: 3G module			

Plot 8.2.4 Radiated emission measurements in 1000 – 2900 MHz range

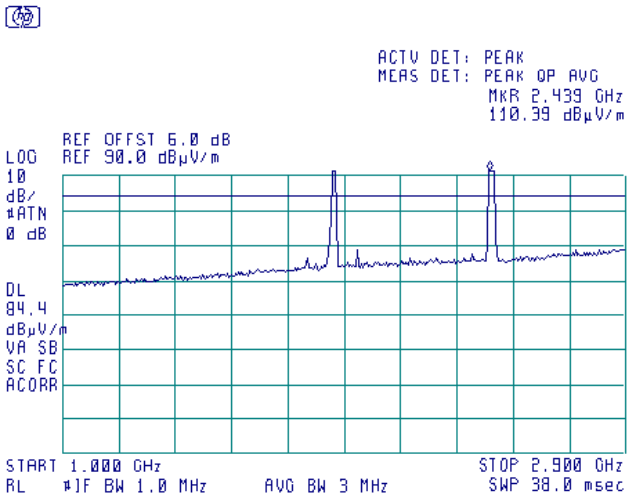
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
CARRIER FREQUENCY: Low



CARRIER FREQUENCY: Mid



CARRIER FREQUENCY: High

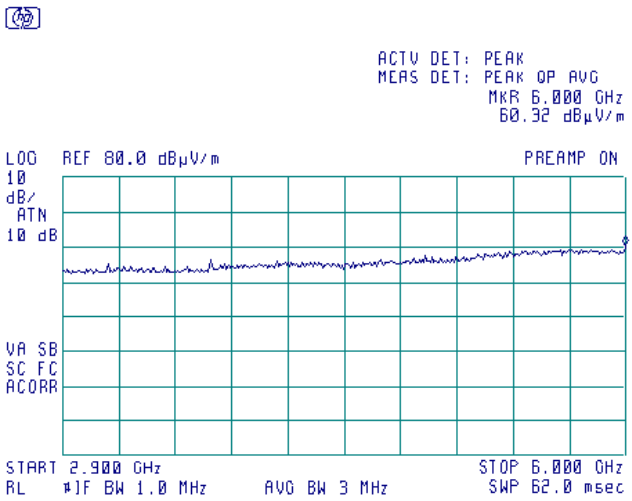


2.44GHz – WiFi fundamental
1852.4 MHz low frequency

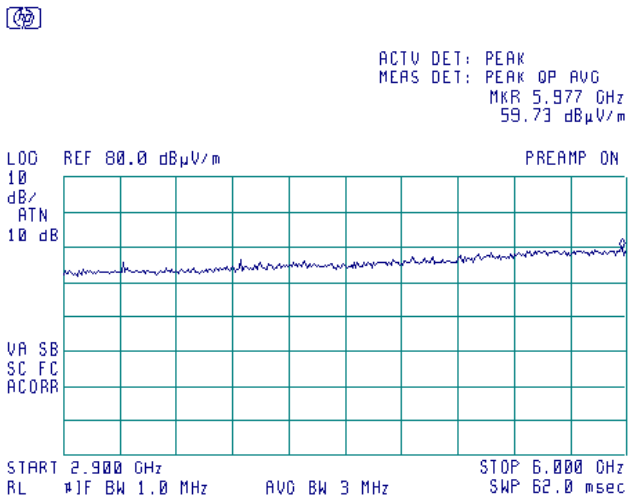
Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	09-Jun-15 - 08-Jul-15		
Temperature: 22 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 3G module			

Plot 8.2.5 Radiated emission measurements in 2900 – 6000 MHz range

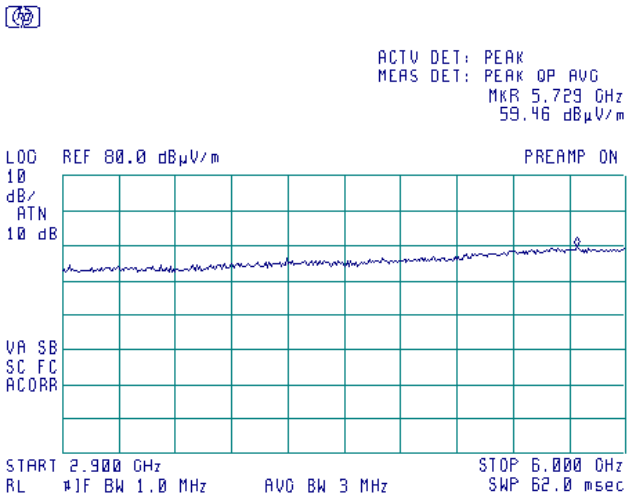
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
CARRIER FREQUENCY: Low



CARRIER FREQUENCY: Mid



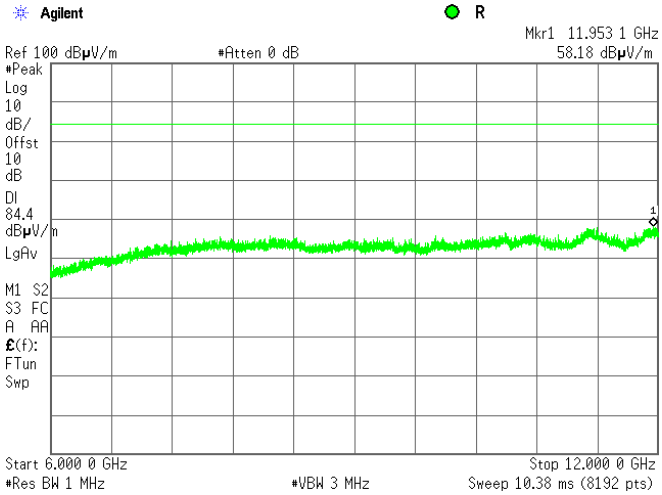
CARRIER FREQUENCY: High



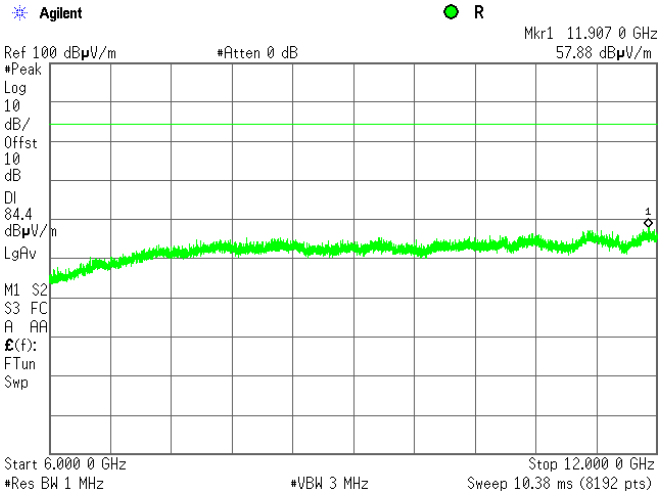
Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	09-Jun-15 - 08-Jul-15		
Temperature: 22 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 3G module			

Plot 8.2.6 Radiated emission measurements in 6.0 – 12.0 GHz range

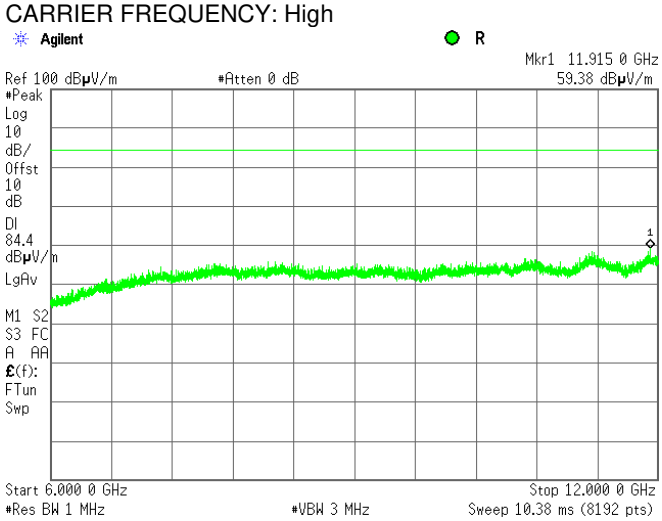
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
CARRIER FREQUENCY: Low



CARRIER FREQUENCY: Mid



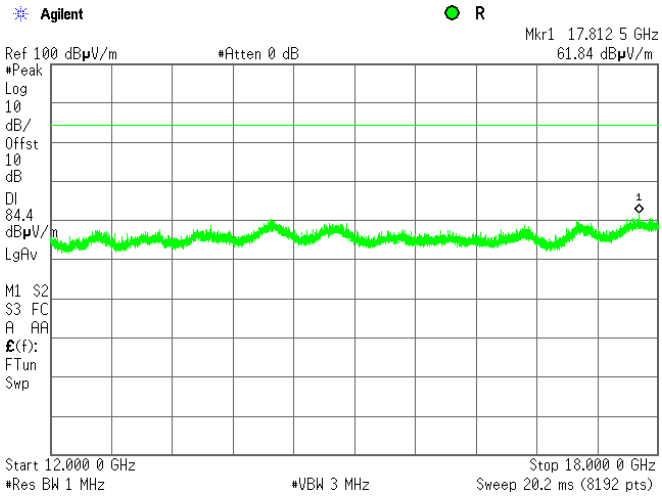
CARRIER FREQUENCY: High



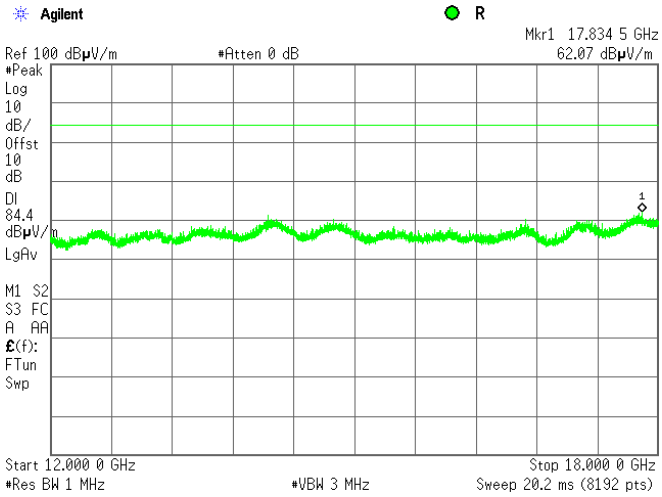
Test specification:	**Section 24.238, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	09-Jun-15 - 08-Jul-15		
Temperature: 22 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 51 %	**Power Supply:** 120 VAC
Remarks: 3G module			

Plot 8.2.7 Radiated emission measurements in 12.0 – 18.0 GHz range

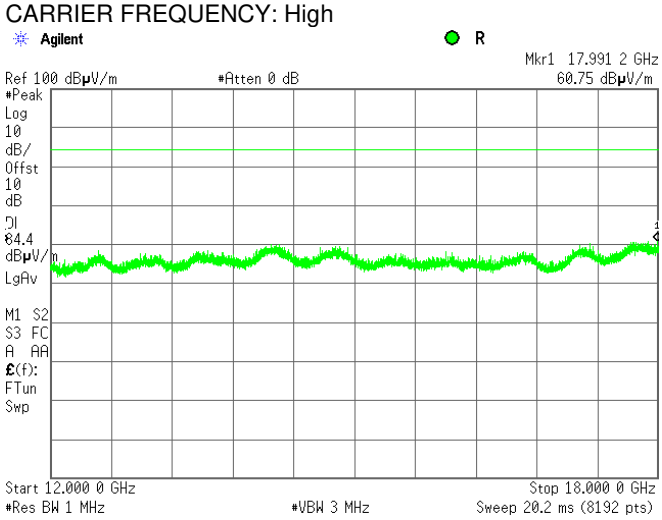
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
CARRIER FREQUENCY: Low



CARRIER FREQUENCY: Mid



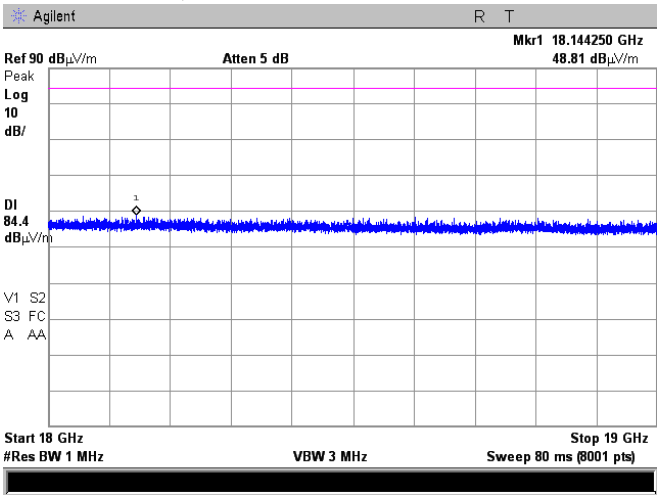
CARRIER FREQUENCY: High



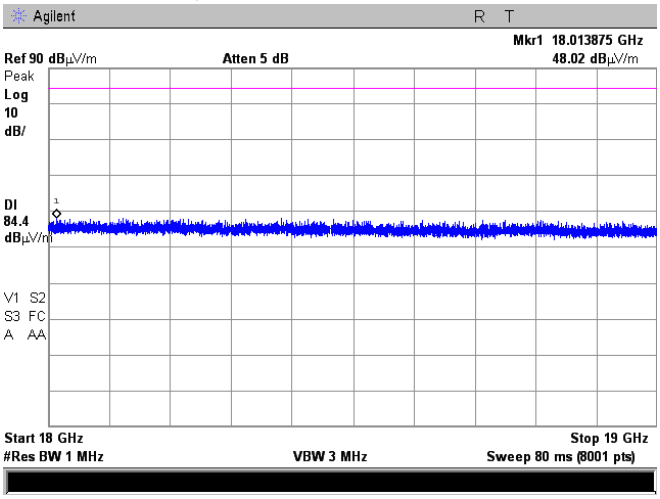
Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	09-Jun-15 - 08-Jul-15		
Temperature: 22 ºC	Air Pressure: 1009 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 3G module			

Plot 8.2.8 Radiated emission measurements in 18.0 – 19.0 GHz range

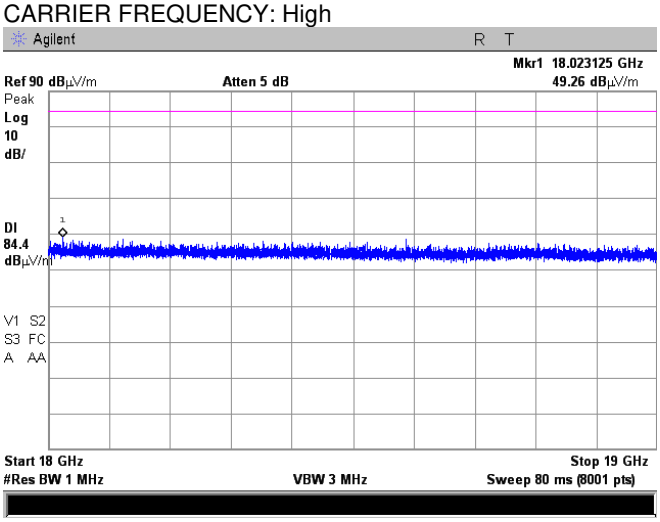
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
CARRIER FREQUENCY: Low



CARRIER FREQUENCY: Mid



CARRIER FREQUENCY: High



Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	09-Jun-15 - 08-Jul-15		
Temperature: 21 ºC	Air Pressure: 1008 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 2G module			

8.3 Radiated spurious emission measurements of 2G module

8.3.1 General

This test was performed to measure radiated spurious emissions from the EUT. Specification test limits are given in Table 8.3.1.

Table 8.3.1 Radiated spurious emission test limits

Frequency, MHz	Attenuation below carrier, dBc	ERP of spurious, dBm	Equivalent field strength limit @ 3m, dB(μV/m)***
0.009 – 10th harmonic*	43+10logP**	-13	84.4

* - Excluding the in band emission within ± 250 % of the authorized bandwidth from the carrier
** - P is transmitter output power in Watts
*** - Equivalent field strength limit was calculated from maximum allowed ERP of spurious as follows: E=sqrt(30×P×1.64)/r, where P is ERP in Watts, 1.64 is numeric gain of ideal dipole and r is antenna to EUT distance in meters

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

8.3.2.1 The EUT was set up as shown in Figure 8.3.1, energized and the performance check was conducted.

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

8.3.2.3 The worst test results (the lowest margins) were recorded in Table 8.3.2 and shown in the associated plots.

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

8.3.3.1 The EUT was set up as shown in Figure 8.3.2, energized and the performance check was conducted.

8.3.3.2 The specified frequency range was investigated with antenna connected to spectrum analyzer. To find maximum radiation the turntable was rotated 360^0 and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal, polarizations.

8.3.3.3 The worst test results (the lowest margins) were recorded in Table 8.3.2 and shown in the associated plots.

8.3.4 Test procedure for substitution ERP measurements of spurious

8.3.4.1 The test equipment was set up as shown in Figure 8.3.3 and energized.

8.3.4.2 RF signal generator was set to the frequency of investigated spurious emission and the RF output level was preliminary adjusted to produce the same field strength as it was measured from the EUT.

8.3.4.3 The test antenna height was swept from 1 to 4 m to find maximum emission from substitution antenna and RF signal generator output was fine adjusted to produce the same field strength as it was measured from the EUT.

8.3.4.4 The above procedure was performed in both, horizontal and vertical, polarizations of the test and substitution antennas.

8.3.4.5 The ERP of spurious emissions was calculated as a sum of signal generator output power in dBm and antenna gain in dBd reduced by cable loss in dB.

8.3.4.6 The above procedure was repeated at the rest of investigated frequencies.

8.3.4.7 The worst test results (the lowest margins) were recorded in Table 8.3.3 and shown in the associated plots.

Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	09-Jun-15 - 08-Jul-15		
Temperature: 21 ºC	Air Pressure: 1008 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 2G module			

Figure 8.3.1 Setup for spurious emission field strength measurements in 9 kHz to 30 MHz band

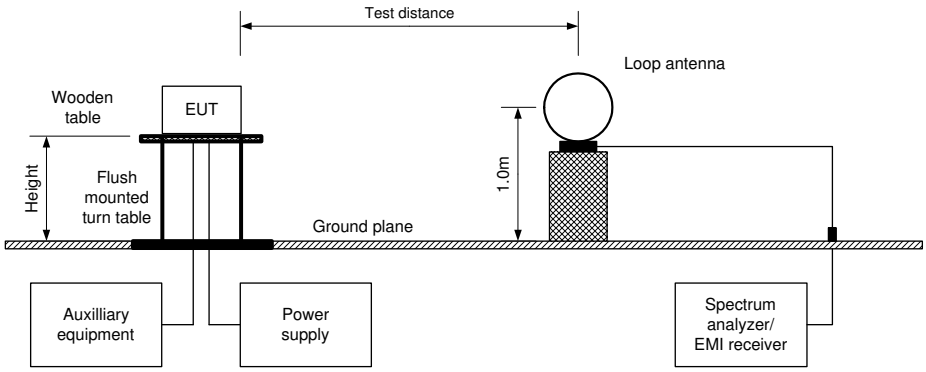
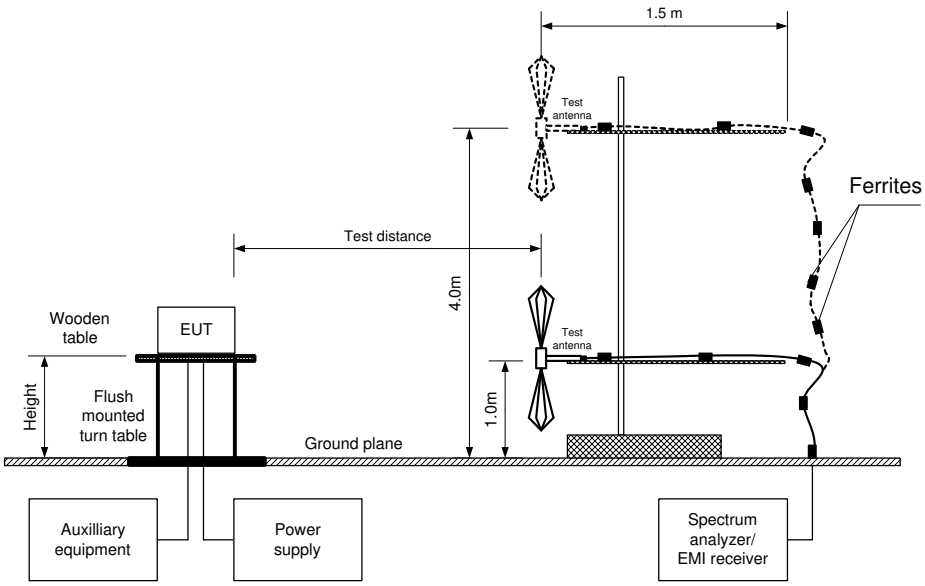
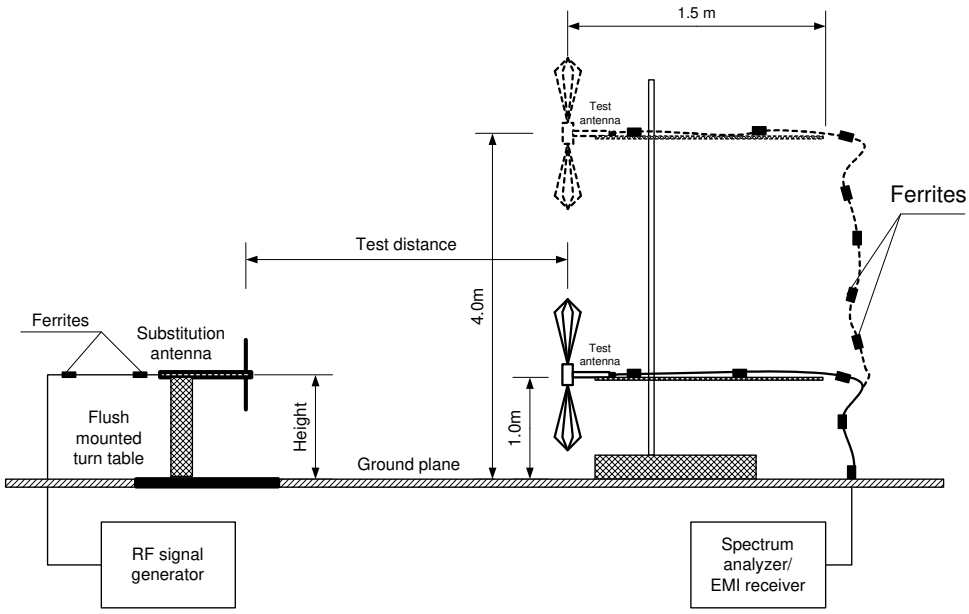


Figure 8.3.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	09-Jun-15 - 08-Jul-15		
Temperature: 21 ºC	Air Pressure: 1008 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 2G module			

Figure 8.3.3 Setup for substitution ERP measurements of spurious



Test specification:	**Section 24.238, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	09-Jun-15 - 08-Jul-15		
Temperature: 21 ºC	**Air Pressure:** 1008 hPa	**Relative Humidity:** 51 %	**Power Supply:** 120 VAC
Remarks: 2G module			

Table 8.3.2 Spurious emission field strength test results

ASSIGNED FREQUENCY RANGE: 1850-1910 MHz
TEST DISTANCE: 3 m
TEST SITE: Semi anechoic chamber
EUT HEIGHT: 0.8 m
INVESTIGATED FREQUENCY RANGE: 0.009 – 19000 MHz
DETECTOR USED: Peak
VIDEO BANDWIDTH: > Resolution bandwidth
TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
Biconilog (30 MHz – 1000 MHz)
Double ridged guide (above 1000 MHz)
MODULATING SIGNAL: PRBS

Frequency, MHz	Field strength, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees
Low carrier frequency 1850.2MHz							
7401.04	65.56	84.4	-18.84	1000	Hor	1.3	170
Mid carrier frequency 1880 MHz							
7520.07	64.44	84.4	-19.96	1000	Hor	1.3	160
High carrier frequency 1909.8 MHz							
7638.92	63.98	84.4	-20.42	1000	Hor	1.6	170

*- Margin = Field strength of spurious – calculated field strength limit.
**- EUT front panel refers to 0 degrees position of turntable.

Table 8.3.3 Substitution EIRP of spurious test results

ASSIGNED FREQUENCY RANGE: 1850-1910 MHz
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
SUBSTITUTION ANTENNA HEIGHT: 0.8 m
DETECTOR USED: Peak
VIDEO BANDWIDTH: > Resolution bandwidth
SUBSTITUTION ANTENNA TYPE: Tunable dipole (30 MHz – 1000 MHz)
Double ridged guide (above 1000 MHz)

Frequency, MHz	Field strength, dB(μV/m)	RBW, kHz	Antenna polarization	RF generator output, dBm	Ant gain, dBi	Cable loss, dB	EIRP, dBm	Limit, dBm	Margin, dB*	Verdict
Low carrier frequency										
7401.04	65.56	1000	Hor	-39.77	9.40	2.71	-33.08	-13.00	-20.08	Pass
Mid carrier frequency										
7520.07	64.44	1000	Hor	-41.02	9.56	2.73	-34.19	-13.00	-21.19	Pass
High carrier frequency										
7638.92	63.98	1000	Hor	-41.79	9.63	2.76	-34.92	-13.00	-21.92	Pass

*- Margin = Spurious emission – specification limit.

Reference numbers of test equipment used

HL 0446	HL 0521	HL 1984	HL 3818	HL 4114	HL 4353	HL 4722	HL 4856
HL 4933							

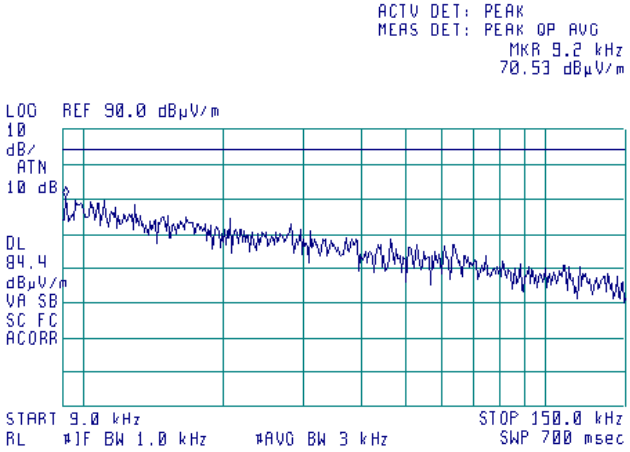
Full description is given in Appendix A.

Test specification:	**Section 24.238, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	09-Jun-15 - 08-Jul-15		
Temperature: 21 ºC	**Air Pressure:** 1008 hPa	**Relative Humidity:** 51 %	**Power Supply:** 120 VAC
Remarks: 2G module			

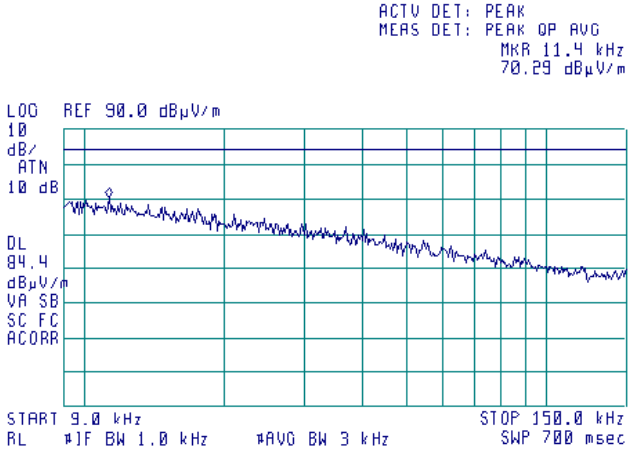
Plot 8.3.1 Radiated emission measurements in 9 - 150 kHz range

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

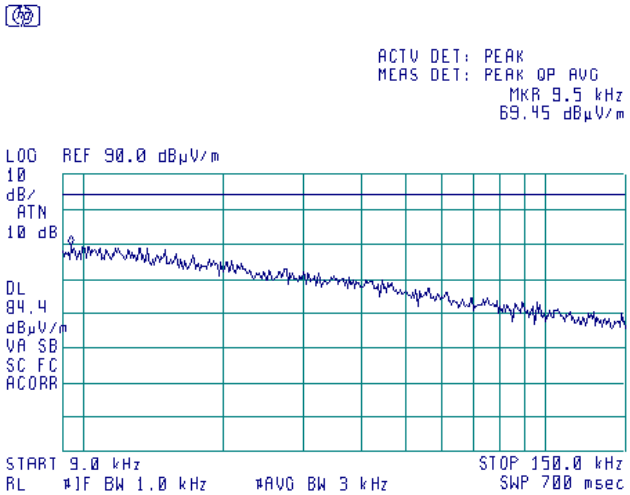
CARRIER FREQUENCY: Low



CARRIER FREQUENCY: Mid



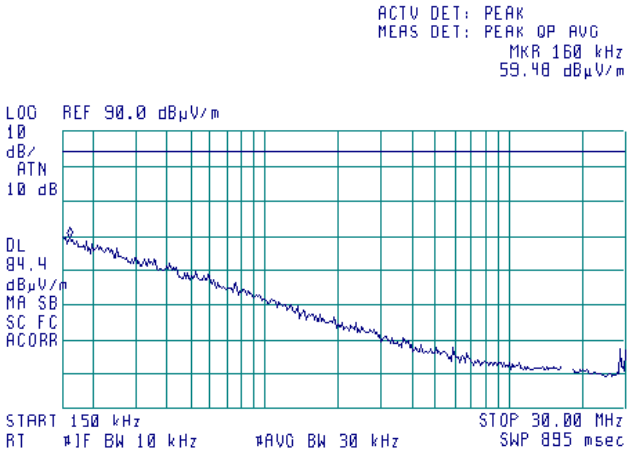
CARRIER FREQUENCY: High



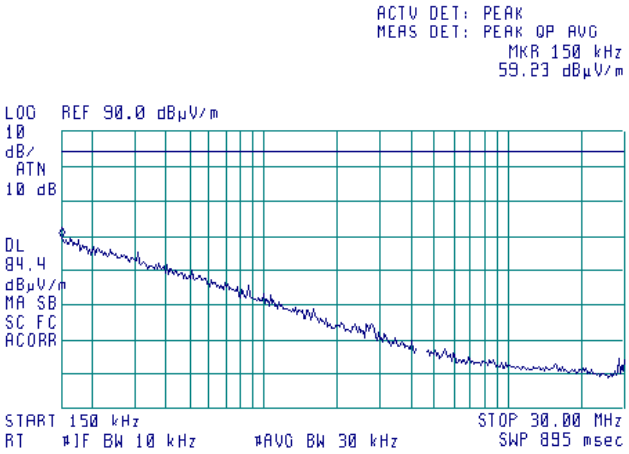
Test specification:	**Section 24.238, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	09-Jun-15 - 08-Jul-15		
Temperature: 21 ºC	**Air Pressure:** 1008 hPa	**Relative Humidity:** 51 %	**Power Supply:** 120 VAC
Remarks: 2G module			

Plot 8.3.2 Radiated emission measurements in 0.15 - 30 MHz range

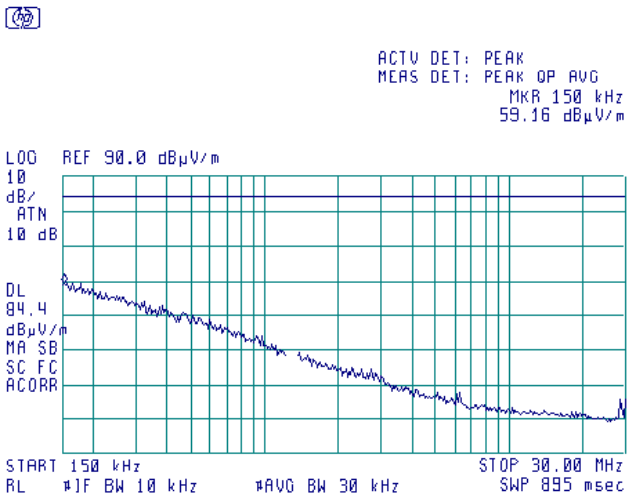
TEST SITE: Semi anechoic chamber
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
CARRIER FREQUENCY: Low



CARRIER FREQUENCY: Mid



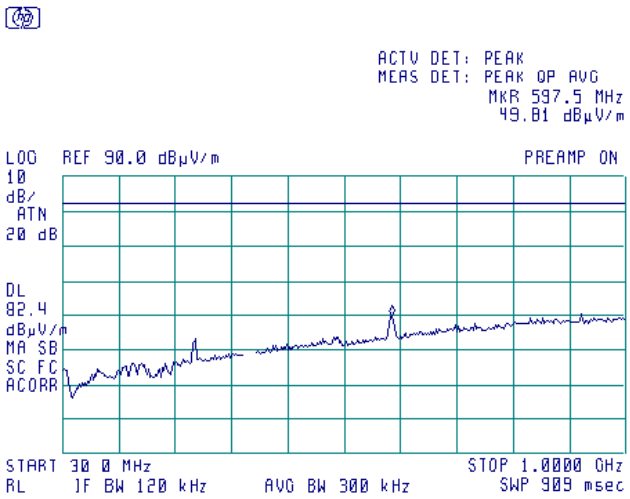
CARRIER FREQUENCY: High



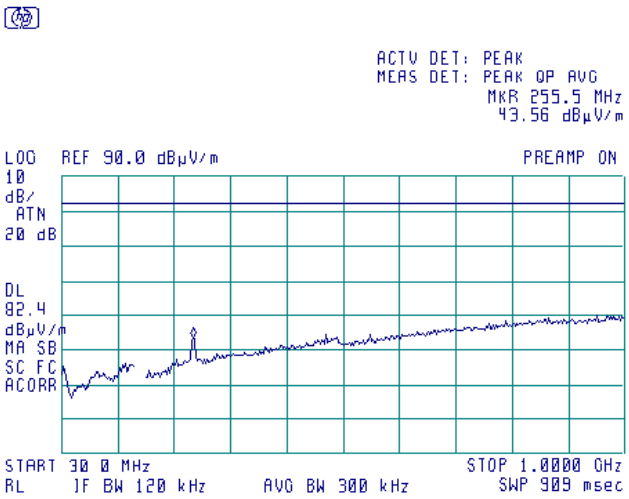
Test specification:	**Section 24.238, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	09-Jun-15 - 08-Jul-15		
Temperature: 21 ºC	**Air Pressure:** 1008 hPa	**Relative Humidity:** 51 %	**Power Supply:** 120 VAC
Remarks: 2G module			

Plot 8.3.3 Radiated emission measurements in 30 - 1000 MHz range

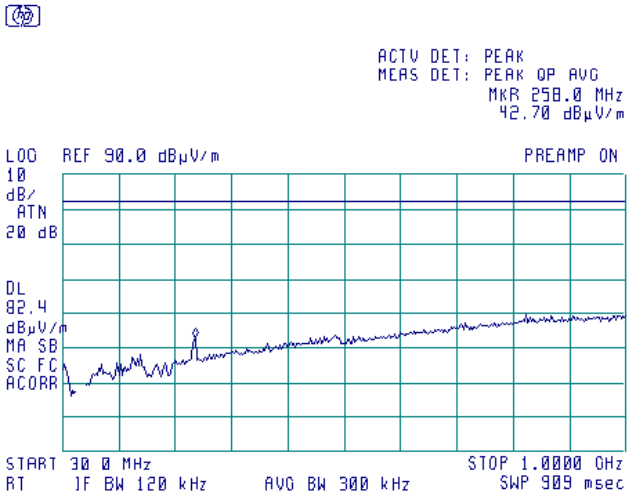
TEST SITE: Semi anechoic chamber
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
CARRIER FREQUENCY: Low



CARRIER FREQUENCY: Mid



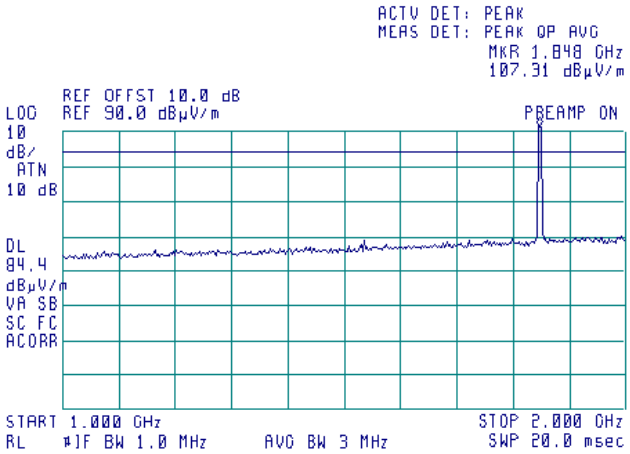
CARRIER FREQUENCY: High



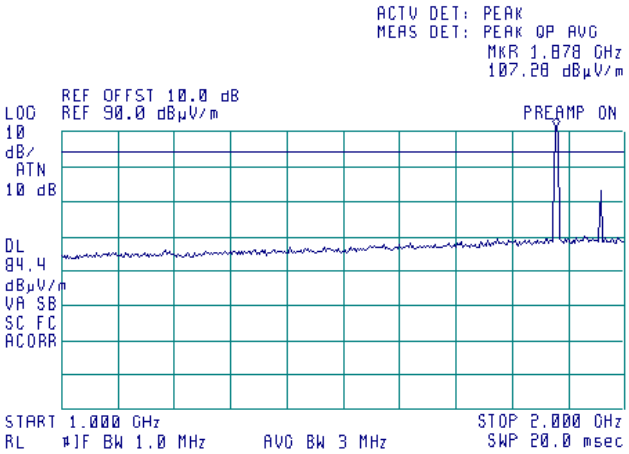
Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	09-Jun-15 - 08-Jul-15		
Temperature: 21 ºC	Air Pressure: 1008 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 2G module			

Plot 8.3.4 Radiated emission measurements in 1000 – 2000 MHz range

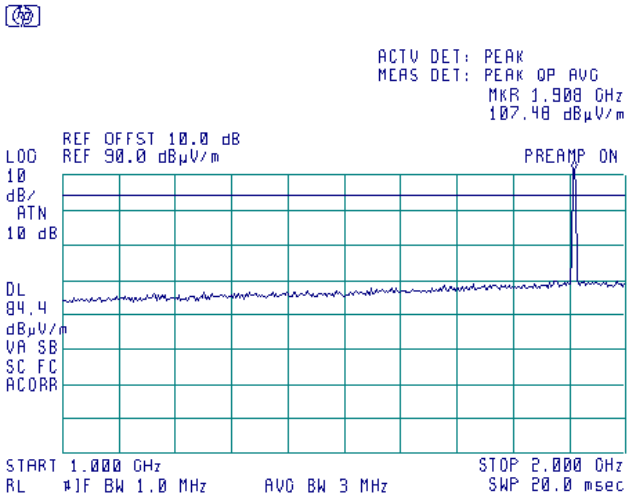
TEST SITE: Semi anechoic chamber
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
CARRIER FREQUENCY: Low



CARRIER FREQUENCY: Mid



CARRIER FREQUENCY: High

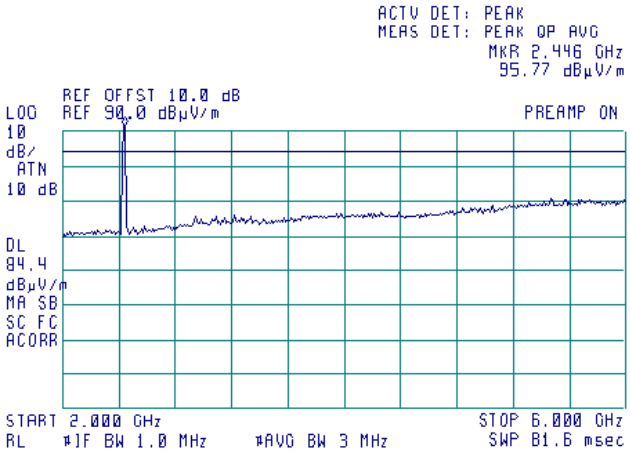


1960 MHz is the auxiliary base station frequency

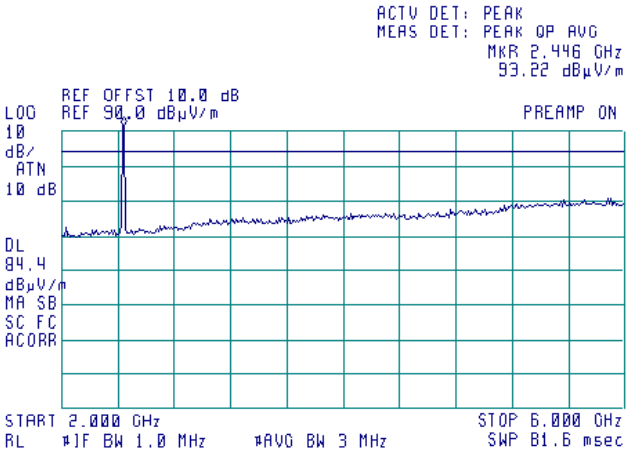
Test specification:	**Section 24.238, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	09-Jun-15 - 08-Jul-15		
Temperature: 21 ºC	**Air Pressure:** 1008 hPa	**Relative Humidity:** 51 %	**Power Supply:** 120 VAC
Remarks: 2G module			

Plot 8.3.5 Radiated emission measurements in 2000 – 6000 MHz range

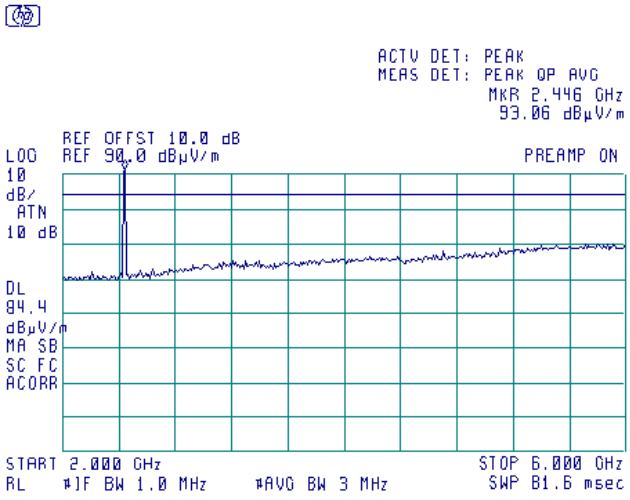
TEST SITE: Semi anechoic chamber
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
CARRIER FREQUENCY: Low



CARRIER FREQUENCY: Mid



CARRIER FREQUENCY: High

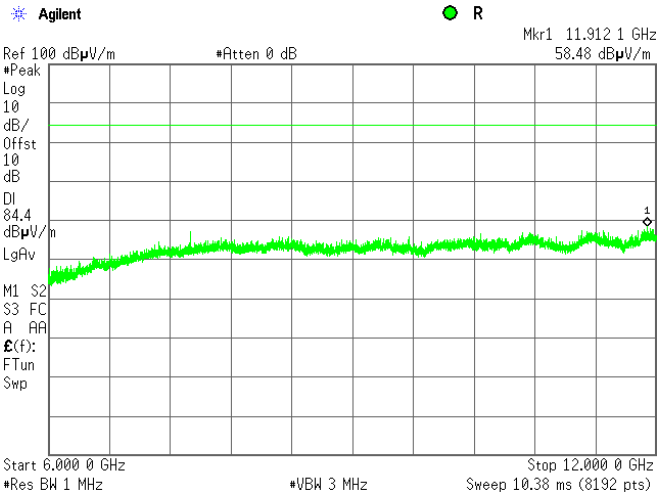


2446 MHz is a carrier frequency of Wi-Fi module

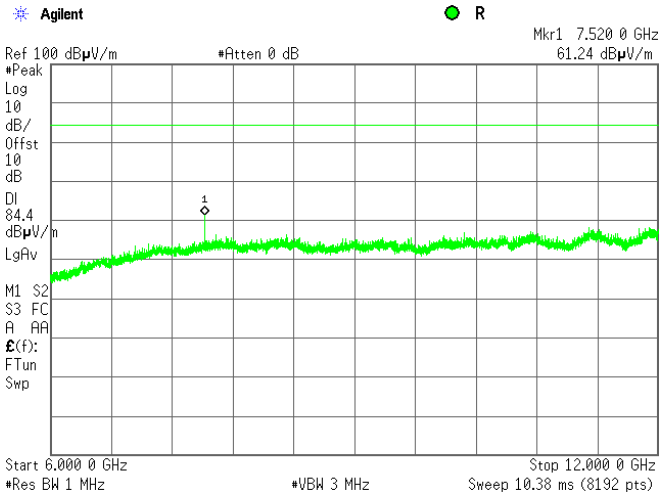
Test specification:	**Section 24.238, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	09-Jun-15 - 08-Jul-15		
Temperature: 21 ºC	**Air Pressure:** 1008 hPa	**Relative Humidity:** 51 %	**Power Supply:** 120 VAC
Remarks: 2G module			

Plot 8.3.6 Radiated emission measurements in 6.0 – 12.0 GHz range

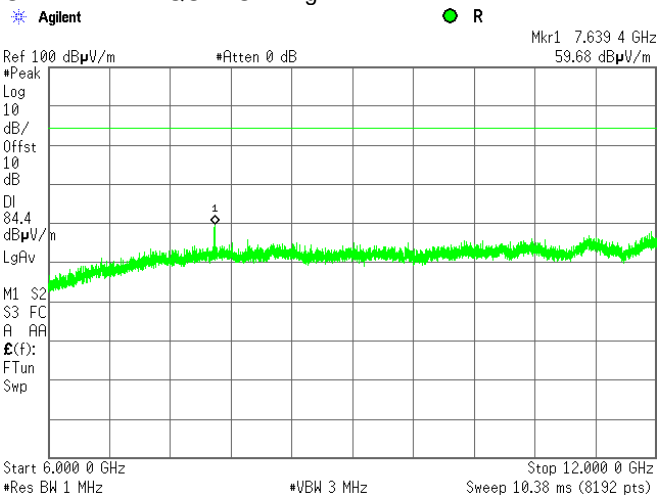
TEST SITE: Semi anechoic chamber
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
CARRIER FREQUENCY: Low



CARRIER FREQUENCY: Mid



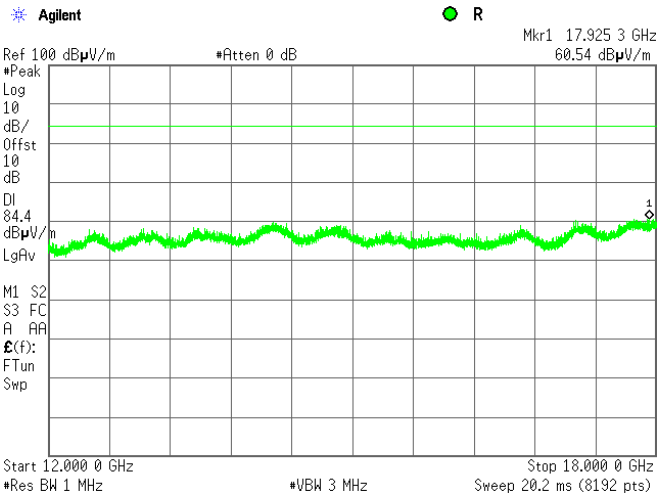
CARRIER FREQUENCY: High



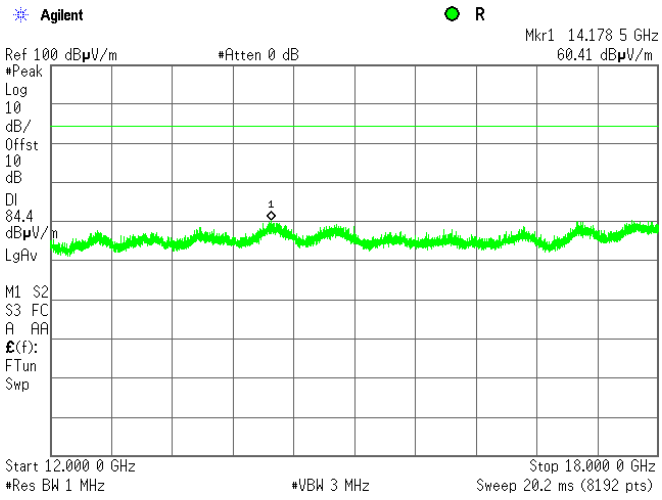
Test specification:	**Section 24.238, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	09-Jun-15 - 08-Jul-15		
Temperature: 21 ºC	**Air Pressure:** 1008 hPa	**Relative Humidity:** 51 %	**Power Supply:** 120 VAC
Remarks: 2G module			

Plot 8.3.7 Radiated emission measurements in 12.0 – 18.0 GHz range

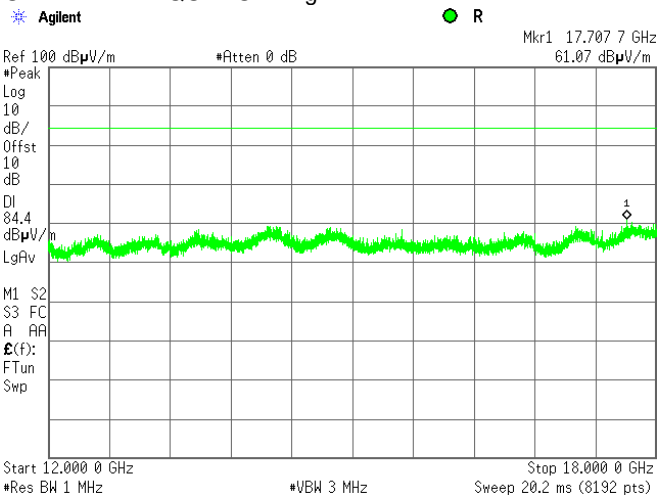
TEST SITE: Semi anechoic chamber
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
CARRIER FREQUENCY: Low



CARRIER FREQUENCY: Mid



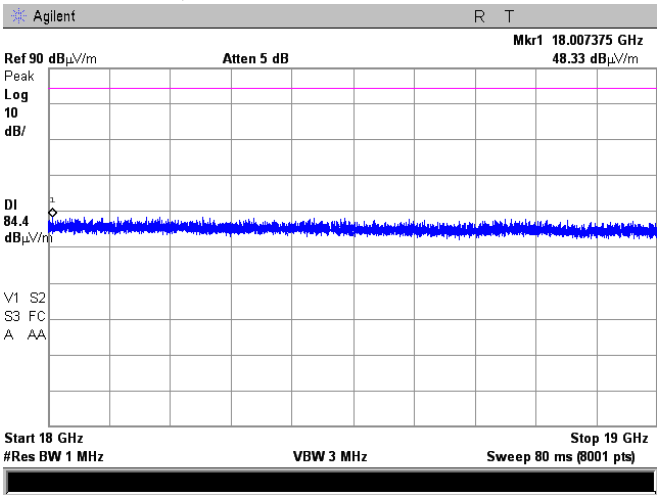
CARRIER FREQUENCY: High



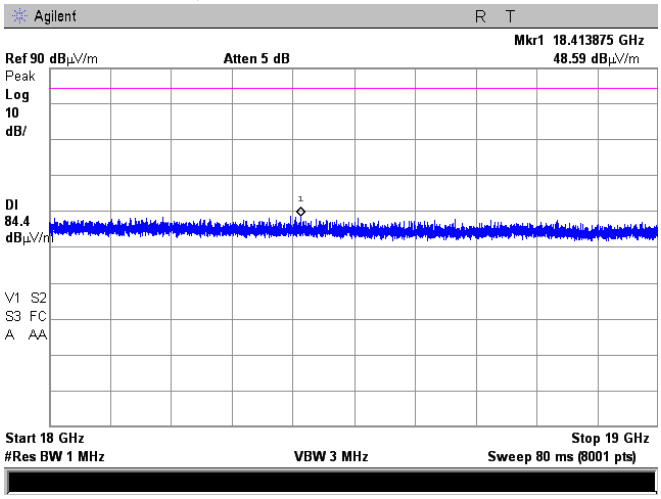
Test specification:	Section 24.238, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	09-Jun-15 - 08-Jul-15		
Temperature: 21 ºC	Air Pressure: 1008 hPa	Relative Humidity: 51 %	Power Supply: 120 VAC
Remarks: 2G module			

Plot 8.3.8 Radiated emission measurements in 18.0 – 19.9 GHz range

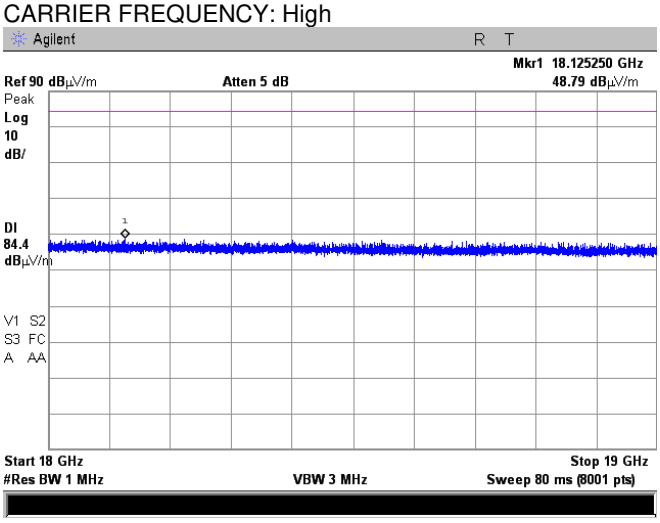
TEST SITE: Semi anechoic chamber
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
CARRIER FREQUENCY: Low



CARRIER FREQUENCY: Mid



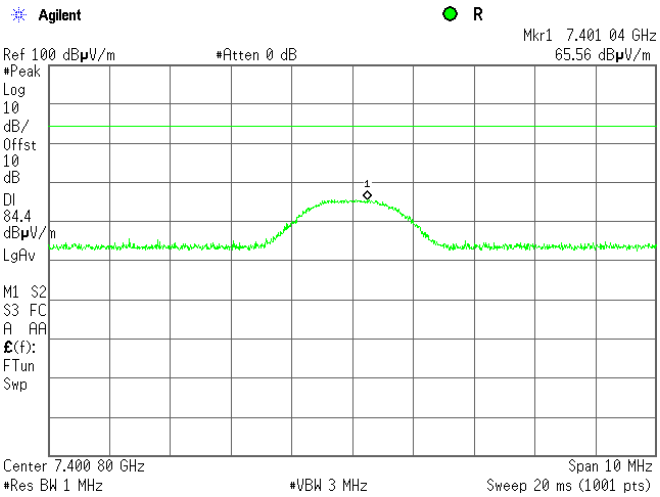
CARRIER FREQUENCY: High



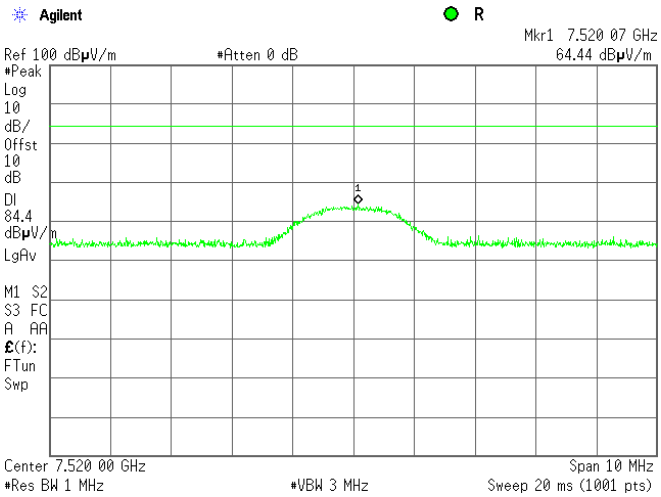
Test specification:	**Section 24.238, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 24.238; TIA/EIA-603-D, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	09-Jun-15 - 08-Jul-15		
Temperature: 21 ºC	**Air Pressure:** 1008 hPa	**Relative Humidity:** 51 %	**Power Supply:** 120 VAC
Remarks: 2G module			

Plot 8.3.9 Radiated emission measurements at the 3rd harmonic

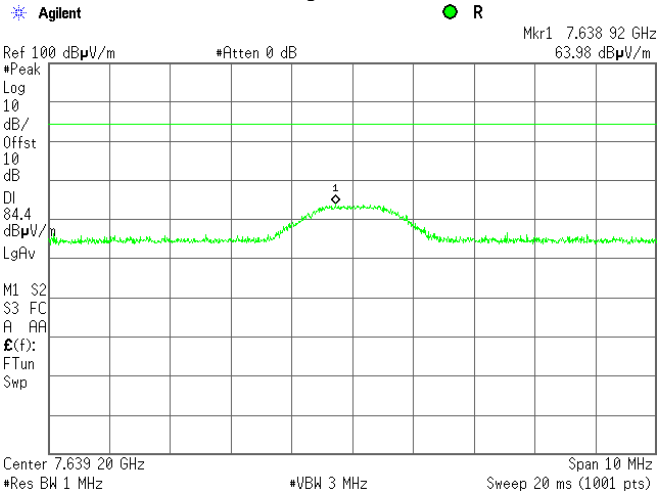
TEST SITE: Semi anechoic chamber
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
CARRIER FREQUENCY: Low



CARRIER FREQUENCY: Mid



CARRIER FREQUENCY: High



9 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
0446	Antenna, Loop, Active, 10 kHz - 30 MHz	EMCO	6502	2857	13-Jan-15	13-Jan-16
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A00253	22-Oct-15	22-Oct-16
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	15-May-15	15-May-16
0661	Generator Swept Signal, 10 MHz to 40 GHz, + 10 dBm	Hewlett Packard	83640B	3614A00266	07-Apr-15	07-Apr-16
1565	Antenna, Dipole, Tunable 500 - 1000 MHz	Electro-Metrics	TDS-30-2	334	05-Feb-15	05-Feb-16
1984	Antenna, Double-Ridged Waveguide Horn, 1 to 18 GHz, 300 W	EMC Test Systems	3115	9911-5964	17-Apr-15	17-Apr-16
2871	Microwave Cable Assembly, 18 GHz, 6.4 m, SMA - SMA	Huber-Suhner	198-8155-00	2871	02-Dec-14	02-Dec-15
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY48250288	29-Apr-15	29-Apr-16
4114	Antenna, Double-Ridged Waveguide Horn, 1 to 18 GHz	ETS Lindgren	3117	00123515	19-Dec-14	19-Dec-15
4279	Test Cable , DC-18 GHz, 4.6 m, N/M - N/M	Mini-Circuits	APC-15FT-NMNM+	0757A	20-Nov-14	20-Nov-15
4353	Low Loss Armored Test Cable, DC - 18 GHz, 6.2 m, N type-M/N type-M	MegaPhase	NC29-N1N1-244	12025101003	15-Mar-15	15-Mar-16
4722	Low Loss Armored Test Cable, DC - 18 GHz, 6.2 m, N type-M/N type-M	MegaPhase	NC29-N1N1-244	51228701001	31-Aug-15	31-Aug-16
4856	Amplifier, solid state, 18 GHz to 40 GHz, 20 dBm output power	Quinstar Technology	QGW-18402023-JO	16779001001	03-Apr-15	03-Apr-16
4933	Active Horn Antenna, 1 GHz to 18 GHz	Com-Power Corporation	AHA-118	701046	04-Sep-15	04-Sep-16

10 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Transmitter tests	
Carrier power conducted at antenna connector	± 1.7 dB
Carrier power radiated (substitution method)	± 4.5 dB
Occupied bandwidth	±8%
Conducted emissions at RF antenna connector	9 kHz to 2.9 GHz: ± 2.6 dB 2.9 GHz to 6.46 GHz: ± 3.5 dB 6.46 GHz to 13.2 GHz: ± 4.3 dB 13.2 GHz to 22.0 GHz: ± 5.0 dB 22.0 GHz to 26.8 GHz: ± 5.5 dB 26.8 GHz to 40.0 GHz: ± 4.8 dB
Spurious emissions radiated 30 MHz – 40 GHz (substitution method)	± 4.5 dB
Frequency stability	30 – 300 MHz: ± 50.5 Hz (1.68 ppm) 300 – 1000 MHz: ± 168 Hz (0.56 ppm)

Hermon Laboratories is accredited by A2LA for calibration according to present requirements of ISO/IEC 17025 and NCSL Z540-1. The accreditation is granted to perform calibration of parameters that are listed in the Scope of Hermon Laboratories Accreditation.
Hermon Laboratories calibrates its reference and transfer standards by calibration laboratories accredited to ISO/IEC 17025 by a mutually recognized Accreditation Body or by a recognized national metrology institute. All reference and transfer standards used in the calibration system are traceable to national or international standards.
In-house calibration of all test and measurement equipment is performed on a regular basis according to Hermon Laboratories calibration procedures, manufacturer calibration/verification procedures or procedures defined in the relevant standards. The Hermon Laboratories test and measurement equipment is calibrated within the tolerances specified by the manufacturers and/or by the relevant standards.

11 APPENDIX C Test laboratory description

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private, EMC, safety, environmental and telecommunication testing facility.
Hermon Laboratories is listed by the Federal Communications Commission (USA) for all parts of Code of Federal Regulations 47 (CFR 47), Registration Numbers 90624 for OATS and 90623 for the anechoic chamber; by Industry Canada for electromagnetic emissions (file number IC 2186A-1 for OATS), certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-1082 for anechoic chamber, C-845 for conducted emissions site, T-1606 for conducted emissions at telecommunication ports), has a status of a Telefication - Listed Testing Laboratory, Certificate No. L138/00. The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO/IEC 17025 for electromagnetic compatibility, product safety, telecommunications testing and environmental simulation (for exact scope please refer to Certificate No. 839.01). The FCC Designation Number is IL1001.

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Person for contact: Mr. Alex Usoskin, CEO.

12 APPENDIX D Specification references

FCC 47CFR part 22: 2014	Private land mobile radio services
FCC 47CFR part 24: 2014	Private land mobile radio services
FCC 47CFR part 1: 2014	Practice and procedure
FCC 47CFR part 2: 2014	Frequency allocations and radio treaty matters; general rules and regulations
ANSI C63.2: 1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
ANSI C63.4: 2009	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
ANSI/TIA/EIA-603-D: 2010	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
RSS-132 issue 3, January 2013	Cellular Telephone Systems Operating in the Bands 824-849 MHz and 869-894 MHz
RSS-133 issue 6 January 2013	2 GHz Personal Communications Services
SRSP-510 issue 4 February 2008	Technical Requirements for Personal Communications Services in the Bands 1850-1915 MHz and 1930-1995 MHz

13 APPENDIX E Test equipment correction factors

Antenna factor
Active loop antenna
Model 6502, S/N 2857, HL 0446

Frequency, MHz	Magnetic antenna factor, dB	Electric antenna factor, dB
0.009	-32.8	18.7
0.010	-33.8	17.7
0.020	-38.3	13.2
0.050	-41.1	10.4
0.075	-41.3	10.2
0.100	-41.6	9.9
0.150	-41.7	9.8
0.250	-41.6	9.9
0.500	-41.8	9.8
0.750	-41.9	9.7
1.000	-41.4	10.1
2.000	-41.5	10.0
3.000	-41.4	10.2
4.000	-41.4	10.1
5.000	-41.5	10.1
10.000	-41.9	9.6
15.000	-41.9	9.6
20.000	-42.2	9.3
25.000	-42.8	8.7
30.000	-44.0	7.5

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μV) to convert it into field strength in dB(μV/m).

Antenna factor
Biconilog antenna EMCO Model 3141
Ser.No.1011, HL 0604

Frequency, MHz	Antenna factor, dB(1/m)	Frequency, MHz	Antenna factor, dB(1/m)	Frequency, MHz	Antenna factor, dB(1/m)
26	7.8	580	20.6	1320	27.8
28	7.8	600	21.3	1340	28.3
30	7.8	620	21.5	1360	28.2
40	7.2	640	21.2	1380	27.9
60	7.1	660	21.4	1400	27.9
70	8.5	680	21.9	1420	27.9
80	9.4	700	22.2	1440	27.8
90	9.8	720	22.2	1460	27.8
100	9.7	740	22.1	1480	28.0
110	9.3	760	22.3	1500	28.5
120	8.8	780	22.6	1520	28.9
130	8.7	800	22.7	1540	29.6
140	9.2	820	22.9	1560	29.8
150	9.8	840	23.1	1580	29.6
160	10.2	860	23.4	1600	29.5
170	10.4	880	23.8	1620	29.3
180	10.4	900	24.1	1640	29.2
190	10.3	920	24.1	1660	29.4
200	10.6	940	24.0	1680	29.6
220	11.6	960	24.1	1700	29.8
240	12.4	980	24.5	1720	30.3
260	12.8	1000	24.9	1740	30.8
280	13.7	1020	25.0	1760	31.1
300	14.7	1040	25.2	1780	31.0
320	15.2	1060	25.4	1800	30.9
340	15.4	1080	25.6	1820	30.7
360	16.1	1100	25.7	1840	30.6
380	16.4	1120	26.0	1860	30.6
400	16.6	1140	26.4	1880	30.6
420	16.7	1160	27.0	1900	30.6
440	17.0	1180	27.0	1920	30.7
460	17.7	1200	26.7	1940	30.9
480	18.1	1220	26.5	1960	31.2
500	18.5	1240	26.5	1980	31.6
520	19.1	1260	26.5	2000	32.0
540	19.5	1280	26.6		
560	19.8	1300	27.0		

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μV) to convert it into field strength in dB(μV/m).

Antenna factor
Double-ridged wave guide horn antenna
Model 3115, S/N 9911-5964, HL1984

Frequency, MHz	Antenna factor, dB(1/m)
1000.0	24.7
1500.0	25.7
2000.0	27.6
2500.0	28.9
3000.0	31.2
3500.0	32.0
4000.0	32.5
4500.0	32.7
5000.0	33.6
5500.0	35.1
6000.0	35.4
6500.0	34.9
7000.0	36.1
7500.0	37.8
8000.0	38.0
8500.0	38.1
9000.0	39.1
9500.0	38.3
10000.0	38.6
10500.0	38.2
11000.0	38.7
11500.0	39.5
12000.0	40.0
12500.0	40.4
13000.0	40.5
13500.0	41.1
14000.0	41.6
14500.0	41.7
15000.0	38.7
15500.0	38.2
16000.0	38.8
16500.0	40.5
17000.0	42.5
17500.0	45.9
18000.0	49.4

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μV) to convert it into field strength in dB(μV/m).

Antenna factor
Double-ridged waveguide horn antenna
ETS Lindgren, Model 3117, serial number: 00123515, HL 4114

Frequency, MHz	Antenna factor, dB/m		
	Measured	Manufacturer	Deviation
1000	28.0	28.4	-0.4
1500	28.0	27.4	0.6
2000	31.2	30.9	0.3
2500	32.5	33.4	-0.9
3000	32.9	32.6	0.3
3500	32.7	32.8	-0.1
4000	33.1	33.4	-0.3
4500	33.8	33.9	-0.1
5000	33.8	34.1	-0.3
5500	34.4	34.5	-0.1
6000	35.0	35.2	-0.2
6500	35.4	35.5	-0.1
7000	35.7	35.7	0.0
7500	35.9	35.7	0.2
8000	35.8	35.8	0.0
8500	35.9	35.8	0.1
9000	36.3	36.2	0.1
9500	36.6	36.6	0.0
10000	37.1	37.1	0.0
10500	37.6	37.5	0.1
11000	37.9	37.7	0.2
11500	38.5	38.1	0.4
12000	39.2	38.7	0.5
12500	39.0	38.9	0.1
13000	39.1	39.1	0.0
13500	38.9	38.8	0.1
14000	39.0	38.8	0.2
14500	39.6	39.9	-0.3
15000	39.9	39.7	0.2
15500	39.9	40.1	-0.2
16000	40.7	40.8	-0.1
16500	41.3	41.8	-0.5
17000	42.5	42.1	0.4
17500	41.3	41.2	0.1
18000	41.4	40.9	0.5

Antenna factor is to be added to receiver meter reading in dB(μV) to convert to field strength in dB(μV/meter)

Cable loss
Cable coaxial, Huber-Suhner, 18 GHz, 6.4 m, SMA - SMA, model 198-8155-00, HL 2871

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.12	5750	2.34	12000	3.55
30	0.14	6000	2.39	12250	3.61
100	0.27	6250	2.46	12500	3.67
250	0.45	6500	2.52	12750	3.74
500	0.63	6750	2.58	13000	3.79
750	0.76	7000	2.64	13250	3.82
1000	0.89	7250	2.68	13500	3.83
1250	1.01	7500	2.73	13750	3.83
1500	1.12	7750	2.78	14000	3.88
1750	1.23	8000	2.83	14250	3.93
2000	1.32	8250	2.88	14500	3.96
2250	1.41	8500	2.94	14750	4.01
2500	1.49	8750	2.97	15000	4.00
2750	1.58	9000	3.02	15250	4.01
3000	1.66	9250	3.07	15500	4.00
3250	1.73	9500	3.13	15750	4.13
3500	1.80	9750	3.18	16000	4.22
3750	1.87	10000	3.21	16250	4.29
4000	1.93	10250	3.26	16500	4.29
4250	2.01	10500	3.30	16750	4.32
4500	2.06	10750	3.36	17000	4.37
4750	2.12	11000	3.39	17250	4.45
5000	2.17	11250	3.44	17500	4.49
5250	2.24	11500	3.48	17750	4.53
5500	2.29	11750	3.52	18000	4.55

Cable loss
Test cable, Mini-Circuits, S/N 0757A, 18 GHz, 4.6 m, N/M - N/M
APC-15FT-NMNM+, HL 4279

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.26	5000	4.23	10200	6.47	15400	8.46
30	0.26	5100	4.28	10300	6.53	15500	8.49
50	0.34	5200	4.32	10400	6.57	15600	8.50
100	0.50	5300	4.37	10500	6.59	15700	8.53
200	0.72	5400	4.41	10600	6.62	15800	8.56
300	0.90	5500	4.46	10700	6.64	15900	8.60
400	1.05	5600	4.51	10800	6.66	16000	8.62
500	1.20	5700	4.57	10900	6.69	16100	8.65
600	1.31	5800	4.61	11000	6.69	16200	8.68
700	1.44	5900	4.64	11100	6.70	16300	8.70
800	1.53	6000	4.70	11200	6.72	16400	8.72
900	1.63	6100	4.75	11300	6.74	16500	8.76
1000	1.74	6200	4.76	11400	6.79	16600	8.77
1100	1.83	6300	4.82	11500	6.83	16700	8.78
1200	1.92	6400	4.83	11600	6.85	16800	8.82
1300	2.01	6500	4.88	11700	6.89	16900	8.85
1400	2.09	6600	4.90	11800	6.94	17000	8.91
1500	2.17	6700	4.95	11900	7.00	17100	8.94
1600	2.25	6800	5.01	12000	7.04	17200	8.98
1700	2.33	6900	4.98	12100	7.10	17300	9.03
1800	2.39	7000	5.03	12200	7.18	17400	9.05
1900	2.47	7100	5.11	12300	7.23	17500	9.08
2000	2.53	7200	5.13	12400	7.29	17600	9.10
2100	2.60	7300	5.20	12500	7.34	17700	9.12
2200	2.67	7400	5.28	12600	7.39	17800	9.14
2300	2.74	7500	5.33	12700	7.45	17900	9.17
2400	2.80	7600	5.37	12800	7.49	18000	9.21
2500	2.87	7700	5.44	12900	7.53		
2600	2.92	7800	5.52	13000	7.58		
2700	3.00	7900	5.56	13100	7.62		
2800	3.06	8000	5.63	13200	7.67		
2900	3.12	8100	5.67	13300	7.71		
3000	3.18	8200	5.71	13400	7.74		
3100	3.24	8300	5.76	13500	7.79		
3200	3.30	8400	5.79	13600	7.82		
3300	3.35	8500	5.85	13700	7.84		
3400	3.41	8600	5.88	13800	7.87		
3500	3.46	8700	5.92	13900	7.90		
3600	3.51	8800	5.96	14000	7.94		
3700	3.56	8900	6.02	14100	7.98		
3800	3.61	9000	6.05	14200	8.01		
3900	3.66	9100	6.08	14300	8.05		
4000	3.71	9200	6.15	14400	8.10		
4100	3.77	9300	6.18	14500	8.12		
4200	3.83	9400	6.20	14600	8.16		
4300	3.89	9500	6.25	14700	8.22		
4400	3.94	9600	6.28	14800	8.26		
4500	3.99	9700	6.31	14900	8.29		
4600	4.05	9800	6.35	15000	8.33		
4700	4.09	9900	6.37	15100	8.39		
4800	4.15	10000	6.40	15200	8.41		
4900	4.19	10100	6.45	15300	8.44		

Cable loss
Low Loss Armored Test Cable, MegaPhase, 18 GHz, 6.2 m, N type-M/N type-M,
NC29-N1N1-244S/N 12025101 003,
HL 4353

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
50	0.20	9000	2.71
100	0.27	9500	2.81
300	0.47	10000	2.90
500	0.61	10500	2.97
1000	0.87	11000	3.06
1500	1.07	11500	3.13
2000	1.24	12000	3.20
2500	1.39	12500	3.26
3000	1.53	13000	3.34
3500	1.65	13500	3.39
4000	1.77	14000	3.47
4500	1.89	14500	3.54
5000	1.99	15000	3.62
5500	2.07	15500	3.69
6000	2.20	16000	3.76
6500	2.30	16500	3.83
7000	2.39	17000	3.86
7500	2.51	17500	3.94
8000	2.58	18000	4.02
8500	2.65		

Cable loss
Low Loss Armored Test Cable, MegaPhase, 18 GHz, 6.2 m, N type-M/N type-M, NC29-N1N1-244, S/N 51228701001
HL 4722

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
50	0.22	9000	2.93
100	0.30	9500	3.06
300	0.52	10000	3.16
500	0.66	10500	3.20
1000	0.93	11000	3.34
1500	1.15	11500	3.39
2000	1.33	12000	3.48
2500	1.49	12500	3.55
3000	1.64	13000	3.66
3500	1.77	13500	3.75
4000	1.90	14000	3.76
4500	2.03	14500	3.87
5000	2.17	15000	3.98
5500	2.30	15500	4.01
6000	2.39	16000	4.14
6500	2.51	16500	4.15
7000	2.59	17000	4.32
7500	2.67	17500	4.36
8000	2.76	18000	4.38
8500	2.84		

14 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
AM	amplitude modulation
AVRG	average (detector)
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dB(μV)	decibel referred to one microvolt
dB(μV/m)	decibel referred to one microvolt per meter
dB(μA)	decibel referred to one microampere
DC	direct current
EIRP	equivalent isotropically radiated power
ERP	effective radiated power
EUT	equipment under test
F	frequency
GHz	gigahertz
GND	ground
H	height
HL	Hermon laboratories
Hz	hertz
k	kilo
kHz	kilohertz
LO	local oscillator
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
μs	microsecond
NA	not applicable
NB	narrow band
OATS	open area test site
Ω	Ohm
PM	pulse modulation
PS	power supply
ppm	part per million (10^{-6})
QP	quasi-peak
RE	radiated emission
RF	radio frequency
rms	root mean square
Rx	receive
s	second
T	temperature
Tx	transmit
V	volt
WB	wideband

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