HERMON LABORATORIES

ELECTRICAL TESTING
0839.01

Hermon Laboratories Ltd.
Harakevet Industrial Zone, Binyamina 30500,
Israel
Tel. +972-4-6288001
Fax. +972-4-6288277
E-mail: mail@hermonlabs.com

TEST REPORT

ACCORDING TO: FCC CFR 47 Part 15 subpart C, section 15.249 and RSS-210 issue 8 Annex 2

FOR:

LogiTag Systems Ltd.
Gate Exciter GPRS
Model:LTG2-11
Door Management Unit GPRS
Model:LTG2-11-PRF
Base Station
Model:LTG2-01
Central Management Unit
Model:LTG2-01-PRF
Gate Locator
Model:LTG2-02
Door Management Unit
Model:LTG2-02-PRF
4 Channel Exciter
Model:LTG2-03
Multi Location Unit
Model:LTG2-03-PRF
FCC ID:Z97LTG2-01

Table of contents

1 Applicant information

Client name:	LogiTag Systems Ltd.
Address:	1st Floor, Building 9, 29 Yad Harutzim street, Poleg Industrial Zone, P.O.B. 8249, Netanya 4250473, Israel
Telephone:	+972 9835 4848
Fax:	+972 9865 6262
E-mail:	golank@Logi-tag.com
Contact name:	Mr. Golan Kormian

2 Equipment under test attributes

Product name:	Gate Exciter GPRS
Model(s):	LTG2-11
Serial number:	1
Hardware version:	C01
Software release:	V2.04
Receipt date	07-Jul-14

3 Manufacturer information

Manufacturer name:	LogiTag Systems Ltd.
Address:	1st Floor, Building 9, 29 Yad Harutzim street, Poleg Industrial Zone, P.O.B. 8249, Netanya 4250473, Israel
Telephone:	+972 9835 4848
Fax:	+972 9865 6262
E-Mail:	golank@Logi-tag.com
Contact name:	Mr. Golan Kormian

4 Test details

Project ID:	25985
Location:	Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started:	13-Jul-14
Test completed:	03-Sep-14
Test specification(s):	FCC 47 CFR Part 15, subpart C, §15.249; RSS-210 issue 8 Annex 2

5 Tests summary

Test	Status
Transmitter characteristics	
FCC Section 15.249(a)(d)/RSS-210, Section A2.9, Field strength of emissions	Pass
FCC Section 15.249(d)/RSS-210, Section A2.9, Band edge emissions	Pass
FCC Section 15.207(a)/RSS-Gen, Section 7.2.4, Conducted emission	Pass
FCC Section 15.203/ RSS-Gen, Section 7.1.2, Antenna requirement	Pass
FCC Section 15.215(c) / RSS-Gen, Section 4.6.1, Occupied bandwidth	Pass

Testing was completed against all relevant requirements of the test standard. The results obtained indicate that the product under test complies in full with the requirements tested.
The test results relate only to the items tested. Pass/ fail decision was based on nominal values.

	Name and Title	Date	Signature
Tested by:	Mrs. E. Pitt, test engineer Mr. A. Chaplik, test engineer	September 4, 2014	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	September 14, 2014	
Approved by:	Mr. M. Nikishin, EMC and Radio group manager	October 29, 2014	

6 EUT description

6.1 General information

The EUT, Gate Exciter GPRS, model number LTG2-11, functionalizes as a combination of Base Station and Gate Locator. It can be the management unit and also direct operation and control of RFID tags.
The device can manage the subunits – gate locators. It carries out the following functionalities:

- **Management unit** –the data that is received on the gate locators is transferred to the unit with an indication on which unit sends the data.
  The unit is able to send configuration info the gate locators via 916 MHz
- **Transferring data** – the unit receives over the UHF band. the messages transmitted by the tags to the gate locator and then to the Gate Exciter GPRS. It can send them a response (to acknowledge the reception); send data to a main server, trigger local hardware through dry-contact interfaces or start a continuous communication session with the tag.
- Generate RF-Zones using an internal 125 kHz transmitter. Each of the unit's channels carries a unique number as an identifier to the location/area where the RF-Zone operates. The device has four LF antenna ports, only one works at a time (two Ceiling and two Door antennas were connected during the tests).
- Operates logical rules: based on events (tag detection, sensor detection, location decision, etc.) that the units detects it activates actions (I/O, parameter update, etc.)
- Function as a repeater to tag's transmissions, relaying it toward the Base-Station unit.

The EUT has the following features/ports:

a) Rx from tag at 433 MHz (UHF1)
b) Tx to tag at 433 MHz (UHF2);
c) Tx/Rx with a tag at 433 MHz (UHF3);
d) Tx/Rx with a one channel exciter in 902-928 MHz (UHF4).

The Gate Exciter GPRS can connect the customer computer/management system via Ethernet, GPRS or WIFI.

The EUT includes the approved by FCC module FCC ID:RI7HE910 manufactured by Telit Communications S.p.A and approved WiFi module FCC ID:TFB-TIWI1-01 manufactured by LS Research, LLC.

The manufacturer's declaration of identity provided in Appendix G of the test report describes the similarity and differences between the models. The model LTG2-11 was tested as the most complex version.
The present test report involves the test results for certification of 902-928 MHz transmitters as a part of a composite application for certification.

6.2 EUT modules and sub-assemblies

Description	Manufacturer	Model or P/N	Hardware rev.	Serial number
Gate Exciter GPRS	LogiTag Systems	LTG2-11	C01	1
Atenna LF Door	LogiTag Systems	LANT-01	NA	1402-010
Atenna LF Door	LogiTag Systems	LANT-01	NA	1402-011
Atenna LF Cieling	LogiTag Systems	LANT-02 PRF	NA	1401056
Atenna LF Cieling	LogiTag Systems	LANT-02-PRF	NA	1401078
Antenna GPRS	Any	Typical	NA	NA

6.3 Ports and lines

Port type	Port description	Connected from	Connected to	Qty.	Cable type	Cable length
Power	DC power	EUT	24V DC power supply	1	Unshielded	1.6 m**
Control	USB2*	EUT	PC	1	Shielded	2 m*
Control	USB1	EUT	Not used	1	NA	NA
Telecom	Ethernet	EUT	Ethernet switch	1	S-FTP	10 m
Control	RS485*	EUT	Open circuit	1	FTP	1 m*
Control	Extension (1, 5, 6)	EUT	LEDs (1;2)	1	FTP	2 m**
Control	Input (7, GND)	EUT	Switch On/Off	2	FTP	2 m**
Control	Input (8)	EUT	Open circuit	1	FTP	2 m**
Control	Input (3, 4; GND)	EUT	Open circuit	3	FTP	1 m**
Control	Input (5, 6; GND)	EUT	Open circuit	3	FTP	1 m**
Control	Input (1, 2, GND)	EUT	Open circuit	1	FTP	1 m**
Control	Relay (R2...R8)	EUT	Open circuit	7	FTP	1 m**
Control	Relay (R1)	EUT	LED 3	1	FTP	2 m**
Control	Outputs (2...8)	EUT	Open circuit	7	FTP	2 m**
Control	Output (1)	EUT	LED 3	1	FTP	2 m**
Signal	LF Antenna	EUT	LF Antenna	4	FTP	2 m**
Signal	GPRS	EUT	GPRS Antenna	1	Coax	3 m**
Signal	Antenna (UHF1...UHF4)	EUT	UHF Antenna	4	NA	NA
Signal	Antenna (Wi-Fi)	EUT	Not used	1	NA	NA

* For maintenance only.
** May be longer than 3 m.

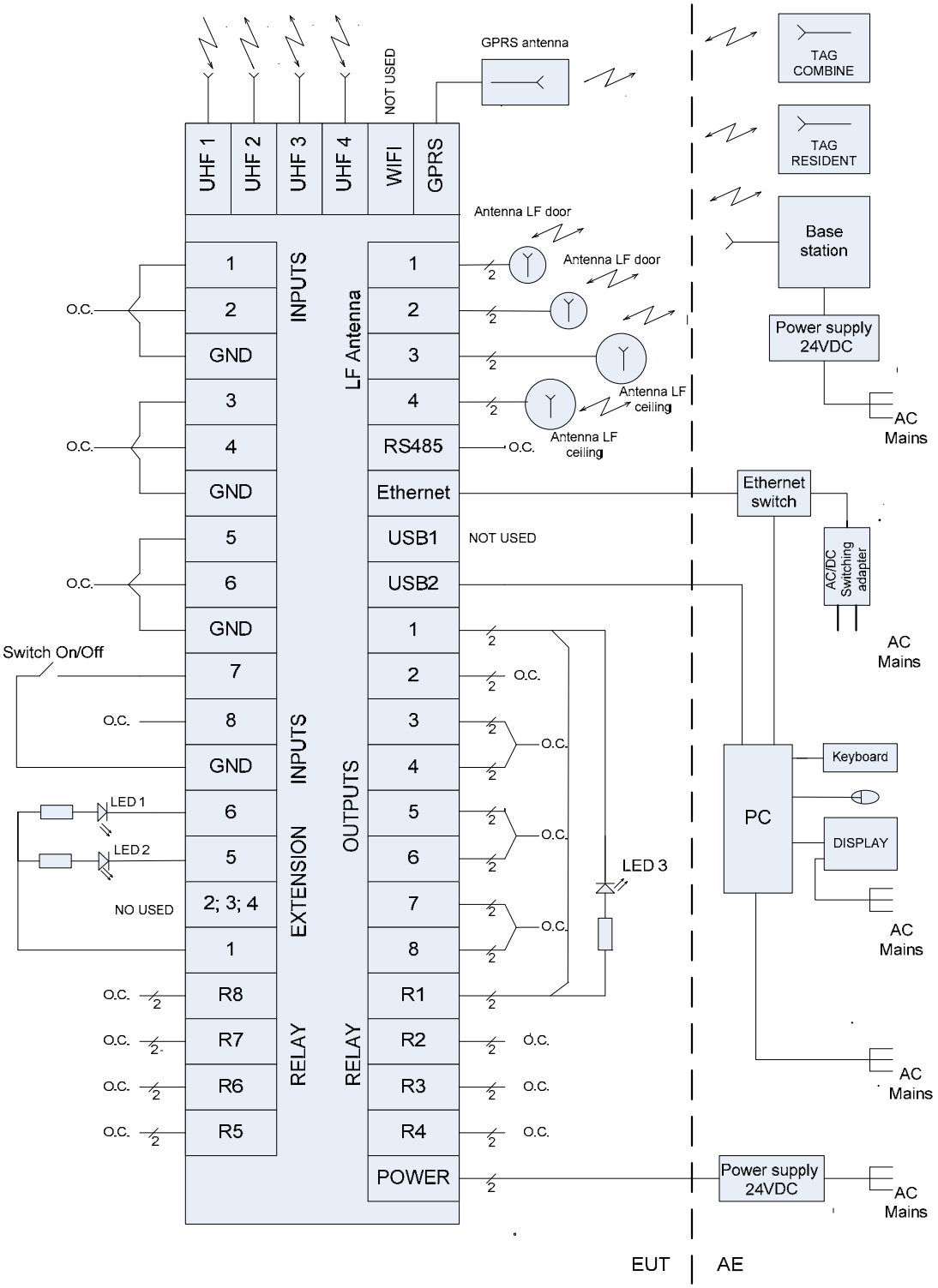
6.4 Support and test equipment

Description	Manufacturer	Model number	Serial number
Base station	LogiTag	LTG2-02	LTG02-1401-003
Power supply 24VDC for Base station	MW Meanwell	GS60A24-P1J	EB27859018
Ethernet Switch	Edimax	ES-3305 P	NA
AC adapter for Ethernet switch	ADVICE	KSAFC120010	NA
PC	Any	Any	Any
AC adapter 24VDC for Gate exciter GPRS	Edacpower Elec.	EA10721B-240	00340
Monitor	SENSE	M989C	1301185SE0754
Keyboard	E-ASER	NA	NA
Mouse	HP	NA	BR1 12257
TAG1	LogiTag	LT comb_TAG	NA
TAG2	LogiTag	LT-RESI_TAG	NA

6.5 Changes made in the EUT

No changes were implemented in the EUT during testing.

6.6 Test configuration



6.7 Transmitter characteristics

Type of equipment						
V	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)					
Assigned frequency range	902 - 928 MHz					
Operating frequency range	902.988 – 926.9835 MHz					
Maximum field strength	93.3 dB(μV/m) at 3 m test distance					
Is transmitter output power variable?	**V**	No				
		Yes		continuous variable		
				stepped variable with stepsize, software controlled	dB	
			Maximum field strength		94 dB(μV/m) at 3 m test distance	
Antenna connection						
unique coupling	**V** standard connector		Integral	with temporary RF connector		
				without temporary RF connector		

Antenna/s technical characteristics			
Type	Manufacturer	Model number	Gain
External	LINX	ANT-916-CW-HWR-SMA	1.9 dBi
External	Chang Hong Technology Co.	GSM-9093-2	1.9 dBi

Transmitter aggregate data rate/s	160 kbps				
Type of modulation	GFSK				
Transmitter duty cycle supplied for test	100%				
Transmitter power source					
	Battery	**Nominal rated voltage**		Battery type	
V	DC	**Nominal rated voltage**	24 VDC via AC/DC adapter		
	AC mains	**Nominal rated voltage**		Frequency	
Common power source for transmitter and receiver			**V** yes		no

Test specification:	Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	15-Aug-14		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 47 %	Power Supply: 24 VDC
Remarks:			

7 Transmitter tests according to 47CFR part 15 subpart C and RSS-210 requirements

7.1 Field strength of emissions

7.1.1 General

This test was performed to measure field strength of fundamental and spurious emissions from the EUT. Specification test limits are given in Table 7.1.1, Table 7.1.2 and Table 7.1.3.

Table 7.1.1 Radiated fundamental emission limits

Fundamental frequency, MHz	Field strength at 3 m, dB(μV/m)		
	Peak	Average	Quasi-Peak
902 – 928	NA	NA	94

Table 7.1.2 Harmonics limits

Fundamental frequency, MHz	Field strength at 3 m, dB(μV/m)	
	Peak	Average
902 – 928	74.0	54.0

Table 7.1.3 Radiated spurious emissions limits (other than harmonics)

Frequency, MHz	Field strength at 3 m, dB(μV/m)*			
	Peak	Quasi Peak	Average	Attenuation below carrier
0.009 – 0.090	148.5 – 128.5	NA	128.5 – 108.5**	50 dBc (whichever is the less stringent)
0.090 – 0.110	NA	108.5 – 106.8**	NA	
0.110 – 0.490	126.8 – 113.8	NA	106.8 – 93.8**	
0.490 – 1.705	NA	73.8 – 63.0**	NA	
1.705 – 30.0*		69.5		
30 – 88		40.0		
88 – 216		43.5		
216 – 960		46.0		
960 - 1000		54.0		
Above 1000	74.0	NA	54.0	

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

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

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

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

Note: The above field strength limits applied from the lowest radio frequency generated in the device, without going below 9 kHz up to the tenth harmonic of the highest fundamental frequency but not exceeding 40 GHz for intentional radiators operated below 10 GHz and up to the fifth harmonic of the highest fundamental frequency but not exceeding 100 GHz for intentional radiators operated above 10 GHz.

Test specification:	Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	15-Aug-14		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 47 %	Power Supply: 24 VDC
Remarks:			

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

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

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

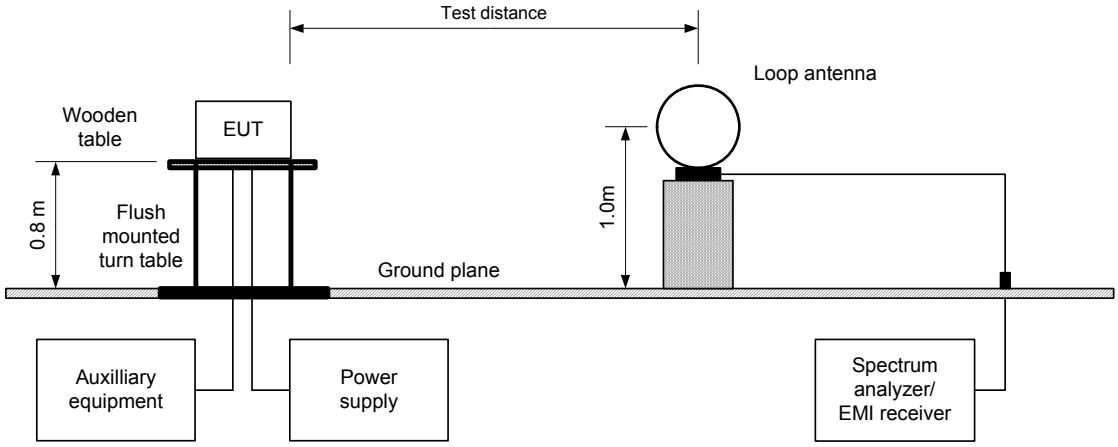
7.1.3 Test procedure for spurious emission field strength measurements above 30 MHz

7.1.3.1 The EUT was set up as shown in Figure 7.1.2, energized and the performance check was conducted.

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

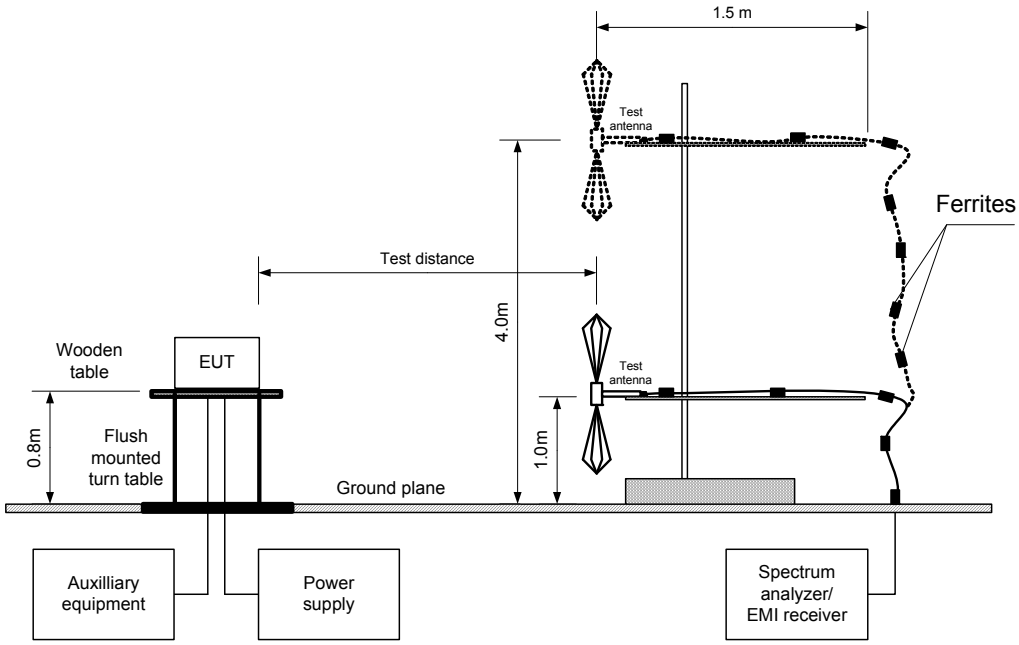
7.1.3.3 The worst test results (the lowest margins) were recorded in the associated tables and shown in the associated plots

Figure 7.1.1 Setup for spurious emission field strength measurements below 30 MHz



Test specification:	Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	15-Aug-14		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 47 %	Power Supply: 24 VDC
Remarks:			

Figure 7.1.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:	Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	15-Aug-14		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 47 %	Power Supply: 24 VDC
Remarks:			

Table 7.1.4 Field strength of fundamental emission and spurious emissions

TEST DISTANCE:	3 m
EUT POSITION:	Vertical and Horizontal
MODULATION:	GFSK
DUTY CUCLE:	100%
INVESTIGATED FREQUENCY RANGE:	0.009 – 9500 MHz
DETECTOR USED:	Peak
RESOLUTION BANDWIDTH:	1.0 kHz (9 kHz – 150 kHz) 9.0 kHz (150 kHz – 30 MHz) 120 kHz (30 MHz – 1000 MHz) 1.0 MHz (above 1000 MHz)
VIDEO BANDWIDTH:	≥ Resolution bandwidth
TEST ANTENNA TYPE:	Active loop (9 kHz – 30 MHz) Biconilog (30 MHz – 1000 MHz) Double ridged guide (above 1000 MHz)

Fundamental emission

Frequency, MHz	Antenna		Azimuth, degrees*	Peak emission, dB(μV/m)	Quasi-peak			Verdict
	Pol.	Height, m			Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**	
902.988	H	1.0	77	93.1	93.0	94.0	-1.0	Pass
914.985	H	1.0	84	93.4	93.3	94.0	-0.7	Pass
926.983	H	1.0	77	92.5	92.4	94.0	-1.6	Pass

Spurious emissions below 1 GHz

Frequency, MHz	Antenna		Azimuth, degrees*	Peak emission, dB(μV/m)	Quasi-peak			Verdict
	Pol.	Height, m			Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**	
85.456	H	1.0	360	36.2	34.3	40.0	-5.7	Pass
250.000	V	1.0	360	40.2	38.2	46.0	-7.8	Pass
264.000	H	1.1	50	39.9	38.3	46.0	-7.7	Pass
300.000	H	1.1	140	42.1	41.4	46.0	-4.6	Pass
400.000	H	1.0	340	41.4	40.6	46.0	-5.4	Pass
500.000	H	1.0	110	43.8	43.0	46.0	-3.0	Pass

Test specification:	Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	15-Aug-14		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 47 %	Power Supply: 24 VDC
Remarks:			

Table 7.1.4 Field strength of fundamental emission and spurious emissions (continued)

Spurious emissions above 1 GHz

F, MHz	Antenna		Azimuth, degrees*	Peak field strength			Measured dBuV/m	Average field strength			Verdict
	Pol.	Height, m		Measured, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**		Calculated, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**	
1805.850	H	1.5	360	53.84	74.00	-20.16	50.99	38.49	54.00	-15.51	Pass
1829.850	H	1.5	350	54.01	74.00	-19.99	50.29	37.79	54.00	-16.21	
1853.850	H	1.5	360	54.37	74.00	-19.63	49.68	37.18	54.00	-16.82	
3611.638	V	1.4	220	45.26	74.00	-28.74	41.13	28.63	54.00	-25.37	
3659.625	V	1.4	240	45.49	74.00	-28.51	42.07	29.57	54.00	-24.43	
3707.638	V	1.4	235	45.85	74.00	-28.15	42.94	30.44	54.00	-23.56	
4514.550	H	1.5	360	53.18	74.00	-20.82	51.97	39.47	54.00	-14.53	
4574.550	H	1.5	360	53.24	74.00	-20.76	51.07	38.57	54.00	-15.43	
4634.600	H	1.5	360	53.34	74.00	-20.66	50.96	38.46	54.00	-15.54	
5417.513	H	1.5	360	51.89	74.00	-22.11	50.63	38.13	54.00	-15.87	
5489.500	H	1.5	360	52.67	74.00	-21.33	51.31	38.81	54.00	-15.19	
5561.438	H	1.5	360	50.20	74.00	-23.8	47.90	35.40	54.00	-18.60	

*- EUT front panel refers to 0 degrees position of turntable.
**- Margin, dB =Measured (calculated) value, dB(μV/m)-Limit, dB(μV/m).

Table 7.1.5 Average factor calculation

Transmission pulse		Transmission burst		Transmission train duration, ms	Average factor, dB
Duration, ms	Period, ms	Duration, ms	Period, ms		
1.375	5.8	NA	NA	NA	-12.5

*- Average factor was calculated as follows

for pulse train shorter than 100 ms: $$Average\ factor = 20 \times \log_{10}\left(\frac{Pulse\ duration}{Pulse\ period} \times \frac{Burst\ duration}{Train\ duration} \times Number\ of\ bursts\ within\ pulse\ train\right)$$

for pulse train longer than 100 ms: $$Average\ factor = 20 \times \log_{10}\left(\frac{Pulse\ duration}{Pulse\ period} \times \frac{Burst\ duration}{100\,ms} \times Number\ of\ bursts\ within\ 100\,ms\right)$$

Reference numbers of test equipment used

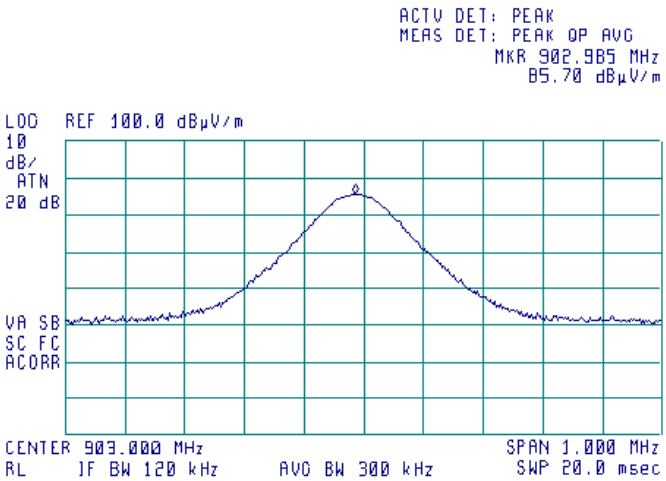
HL 0446	HL 0521	HL 0604	HL 2432	HL 2909	HL 3531	HL 4114	HL 4353
HL 4722							

Full description is given in Appendix A.

Test specification:	Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	15-Aug-14		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 47 %	Power Supply: 24 VDC
Remarks:			

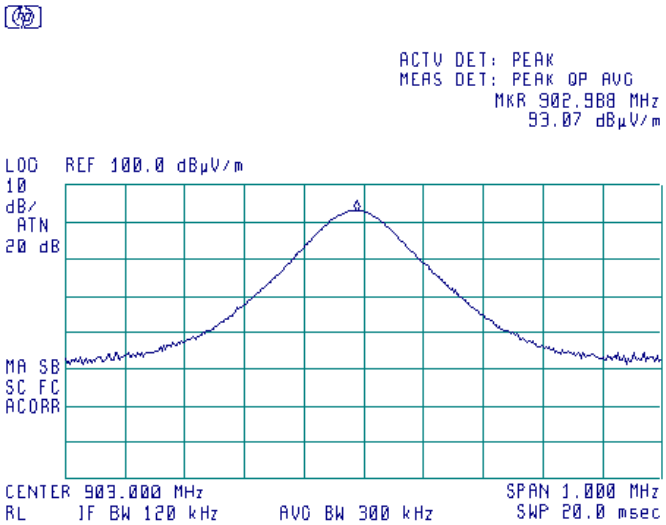
Plot 7.1.1 Radiated emission measurements at the low fundamental frequency

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



Plot 7.1.2 Radiated emission measurements at the low fundamental frequency

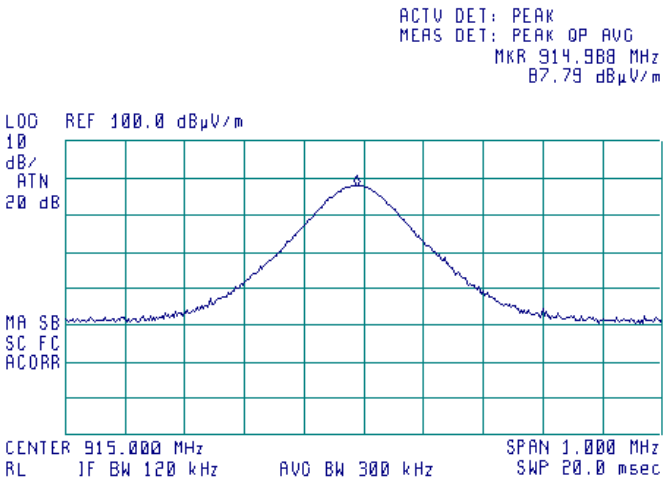
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Vertical and Horizontal



Test specification:	Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	15-Aug-14		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 47 %	Power Supply: 24 VDC
Remarks:			

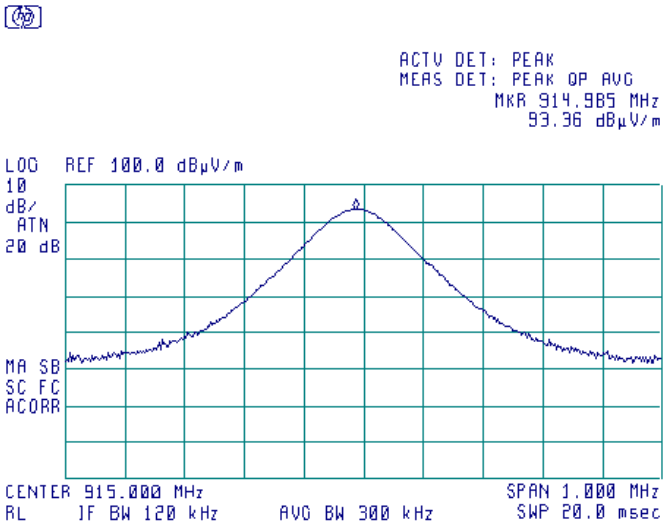
Plot 7.1.3 Radiated emission measurements at the mid fundamental frequency

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



Plot 7.1.4 Radiated emission measurements at the mid fundamental frequency

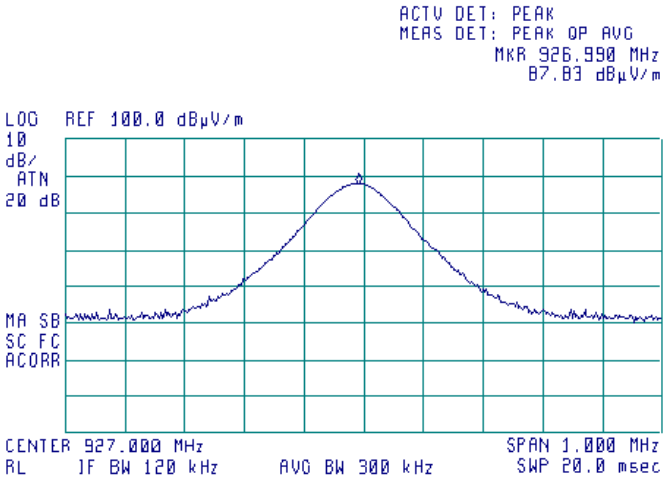
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Vertical and Horizontal



Test specification:	Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	15-Aug-14		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 47 %	Power Supply: 24 VDC
Remarks:			

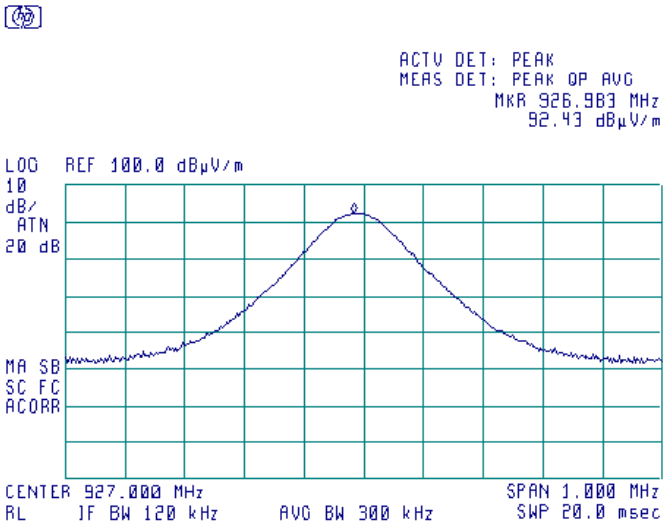
Plot 7.1.5 Radiated emission measurements at the high fundamental frequency

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



Plot 7.1.6 Radiated emission measurements at the high fundamental frequency

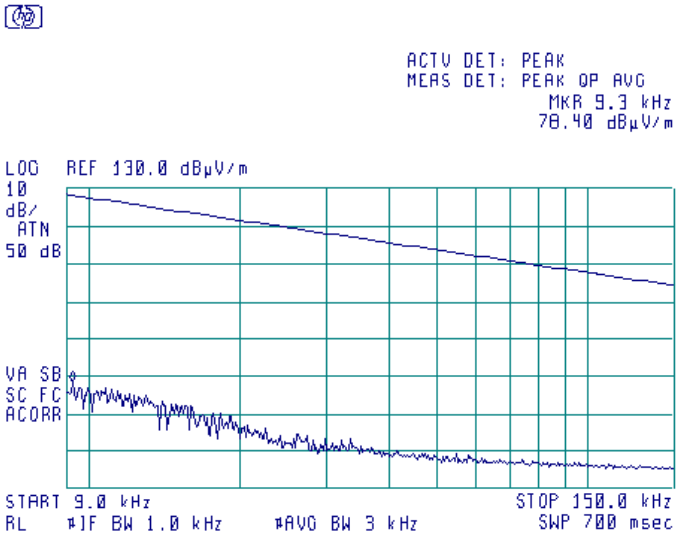
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Vertical and Horizontal



Test specification:	Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	15-Aug-14		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 47 %	Power Supply: 24 VDC
Remarks:			

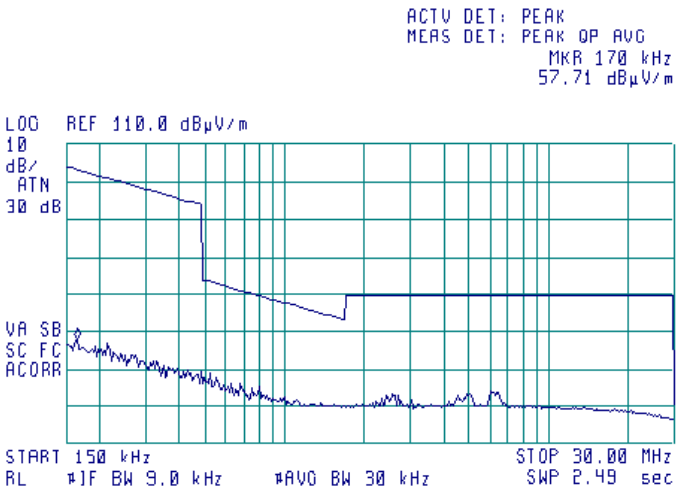
Plot 7.1.7 Radiated emission measurements from 9 to 150 kHz at low, mid, high frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Plot 7.1.8 Radiated emission measurements from 150 to 30 MHz at low, mid, high frequency

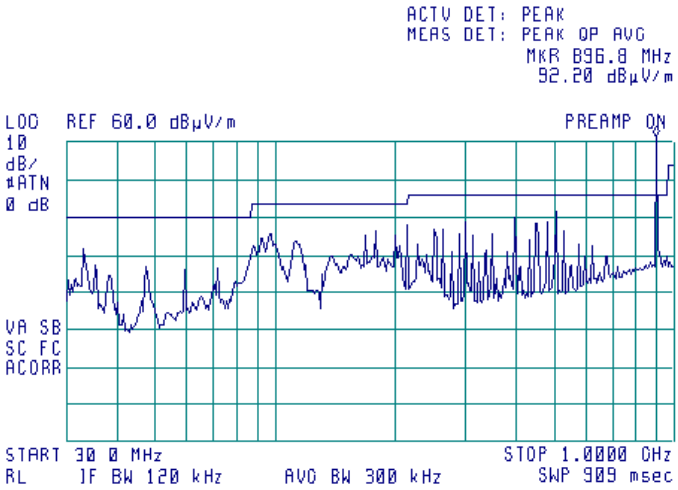
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Test specification:	Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	15-Aug-14		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 47 %	Power Supply: 24 VDC
Remarks:			

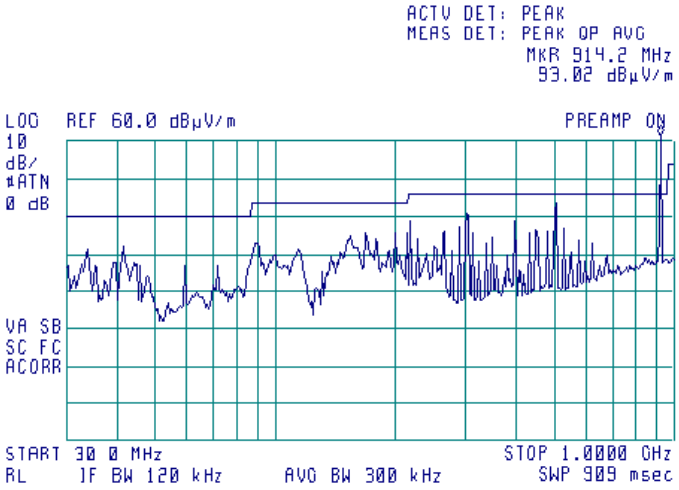
Plot 7.1.9 Radiated emission measurements from 30 to 1000 MHz at low frequency

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



Plot 7.1.10 Radiated emission measurements from 30 to 1000 MHz at mid frequency

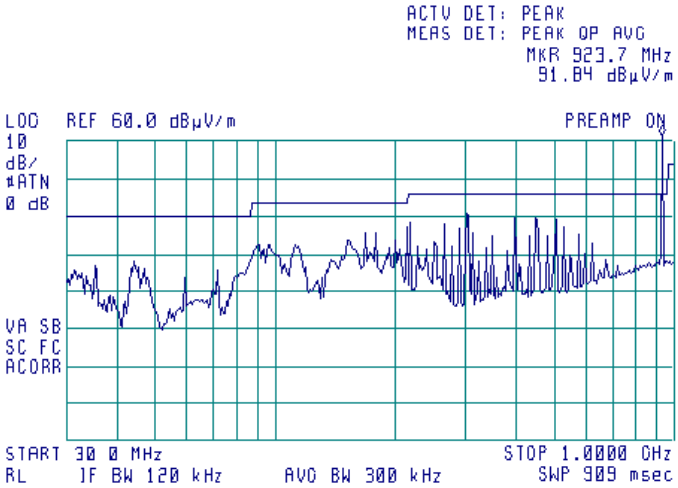
TEST SITE:	Semi anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical and Horizontal
EUT POSITION:	Vertical and Horizontal



Test specification:	Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	15-Aug-14		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 47 %	Power Supply: 24 VDC
Remarks:			

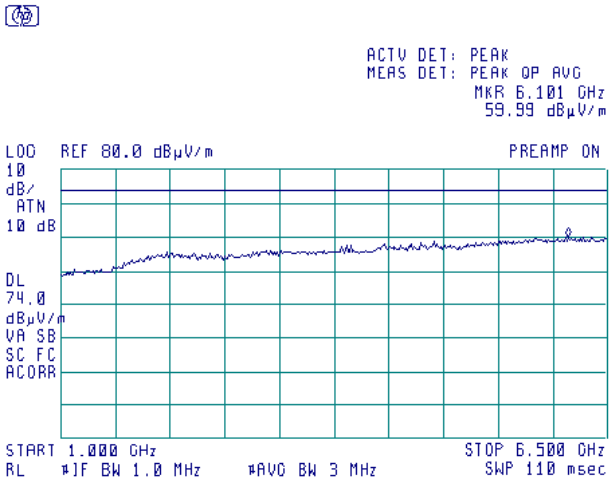
Plot 7.1.11 Radiated emission measurements from 30 to 1000 MHz at high frequency

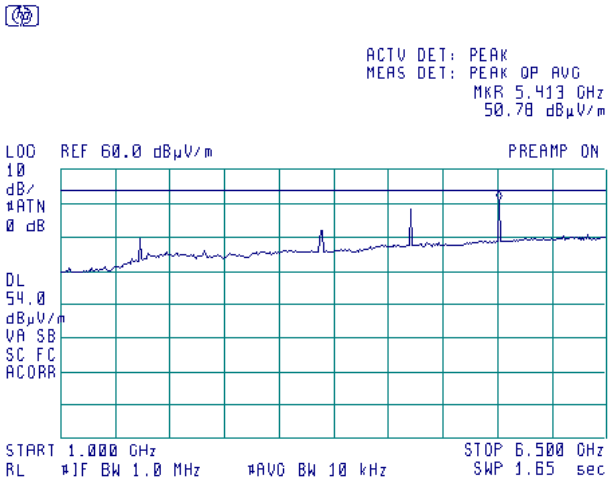
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Vertical and Horizontal



Plot 7.1.12 Radiated emission measurements from 1.0 to 6.5 MHz at low frequency

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

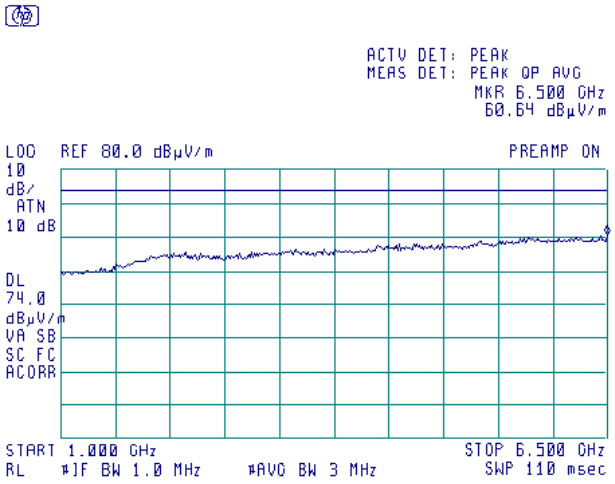


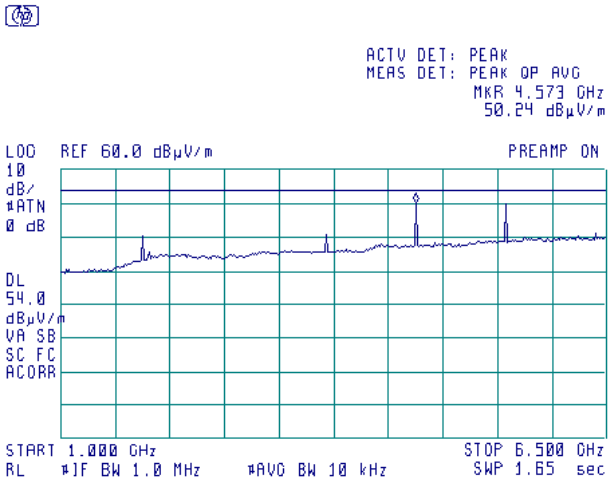


Test specification:	Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	15-Aug-14		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 47 %	Power Supply: 24 VDC
Remarks:			

Plot 7.1.13 Radiated emission measurements from 1.0 to 6.5 MHz at mid frequency

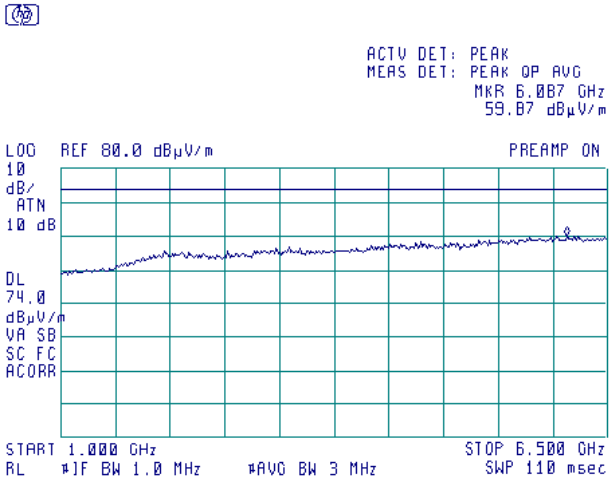
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Vertical and Horizontal

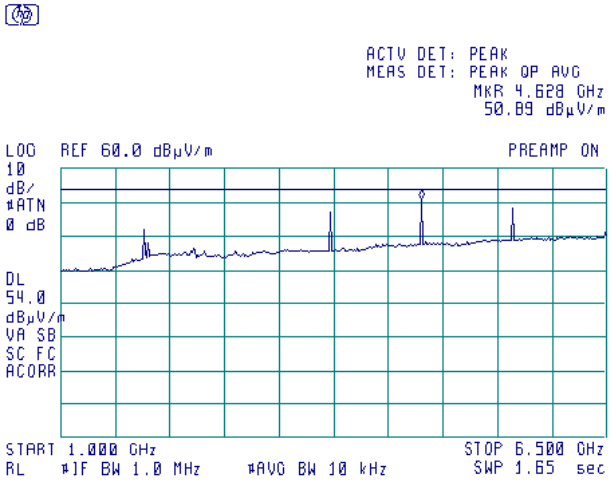




Plot 7.1.14 Radiated emission measurements from 1.0 to 6.5 MHz at high frequency

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

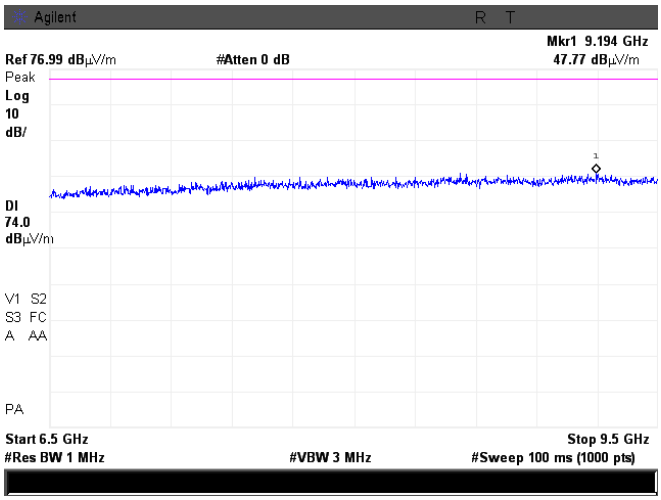


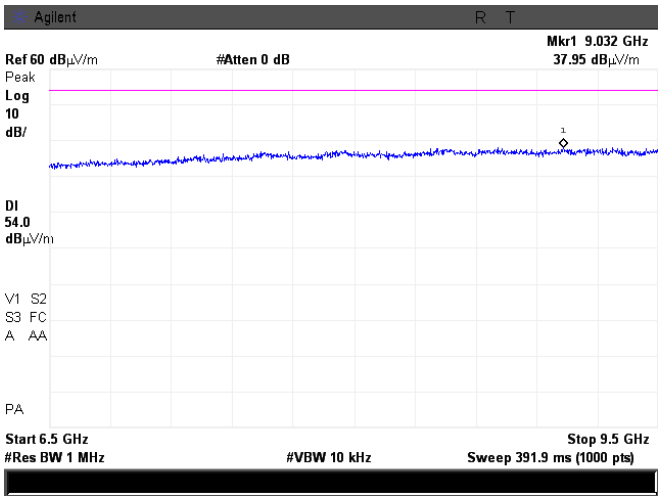


Test specification:	Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	15-Aug-14		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 47 %	Power Supply: 24 VDC
Remarks:			

Plot 7.1.15 Radiated emission measurements from 6.5 to 9.5 MHz at low frequency

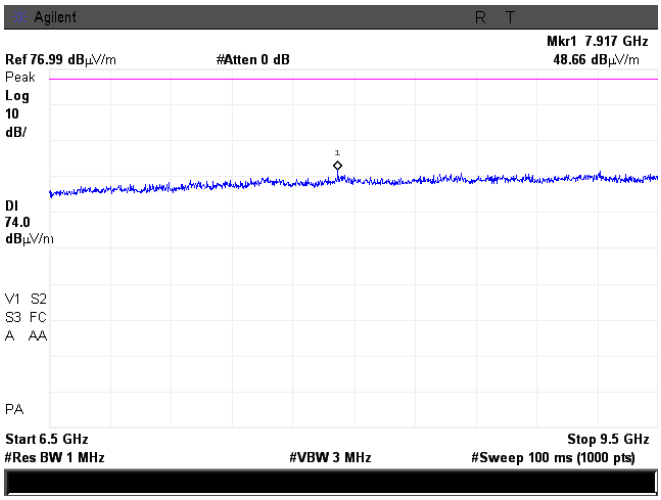
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Vertical and Horizontal

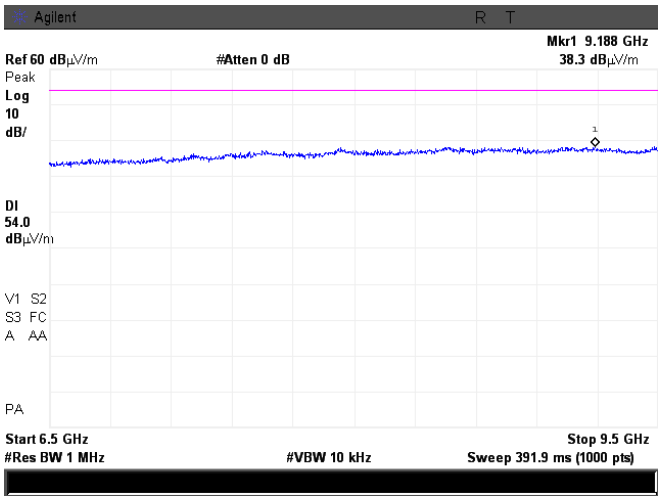




Plot 7.1.16 Radiated emission measurements from 6.5 to 9.5 MHz at mid frequency

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

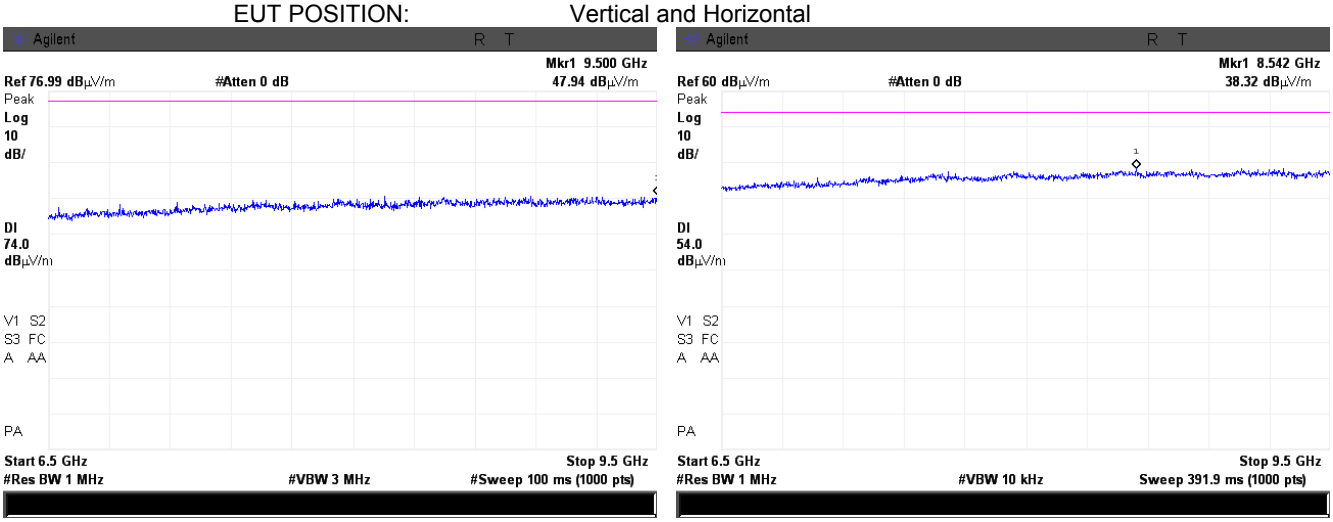




Test specification:	Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	15-Aug-14		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 47 %	Power Supply: 24 VDC
Remarks:			

Plot 7.1.17 Radiated emission measurements from 6.5 to 9.5 MHz at high frequency

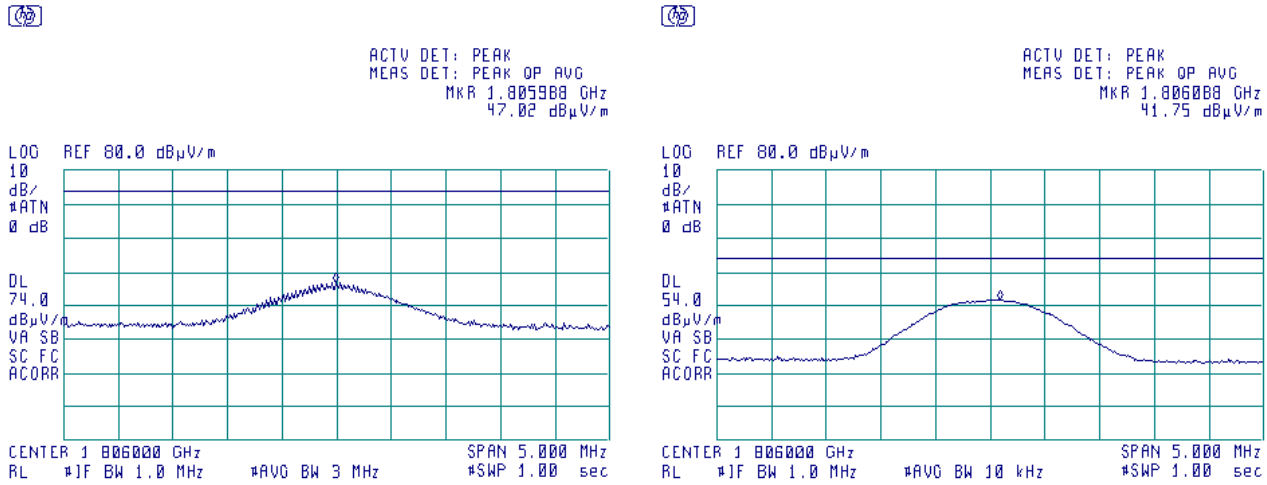
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Vertical and Horizontal



Test specification:	Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	15-Aug-14		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 47 %	Power Supply: 24 VDC
Remarks:			

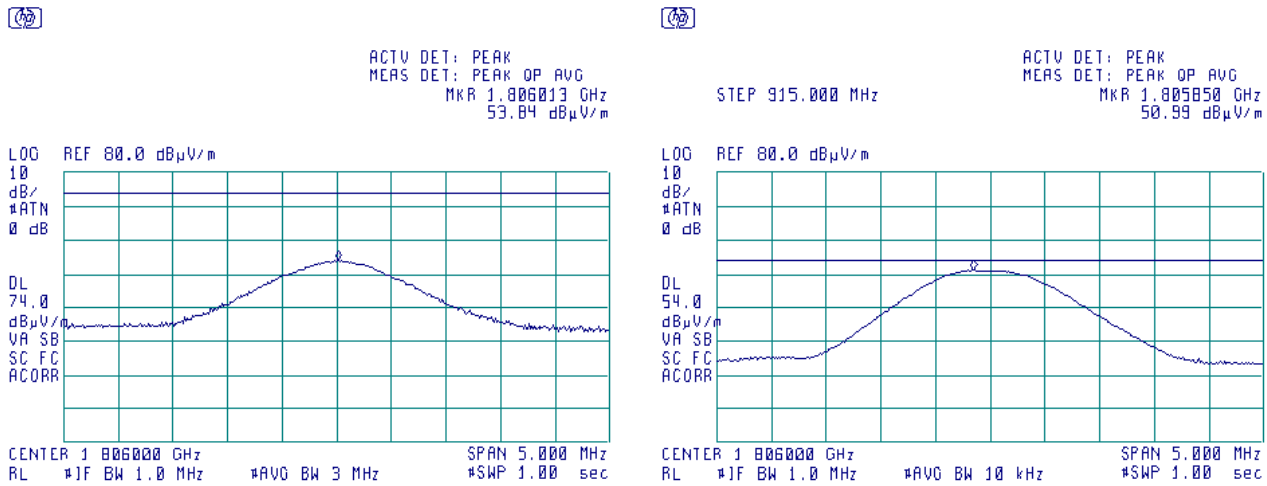
Plot 7.1.18 Radiated emission measurements at the second harmonic frequency at low frequency

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



Plot 7.1.19 Radiated emission measurements at the second harmonic frequency at low frequency

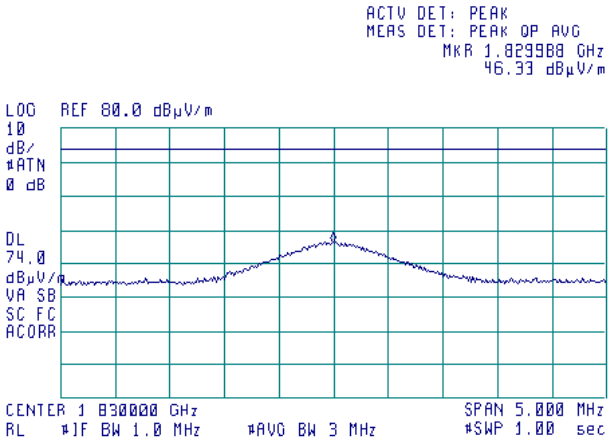
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal

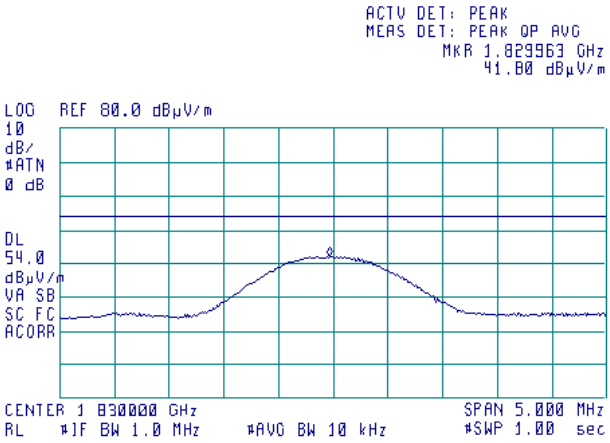


Test specification:	Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	15-Aug-14		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 47 %	Power Supply: 24 VDC
Remarks:			

Plot 7.1.20 Radiated emission measurements at the second harmonic frequency at mid frequency

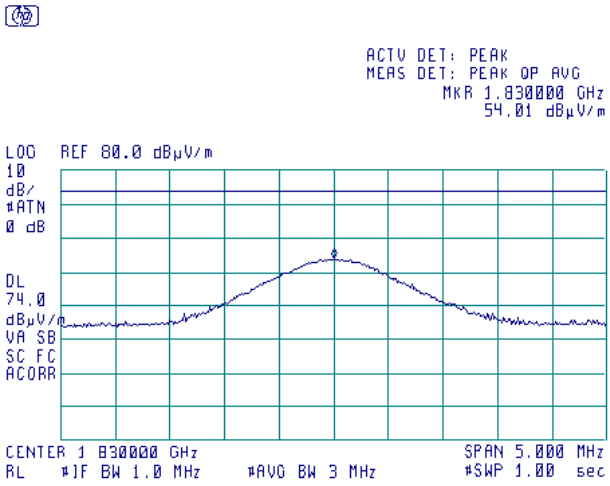
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical

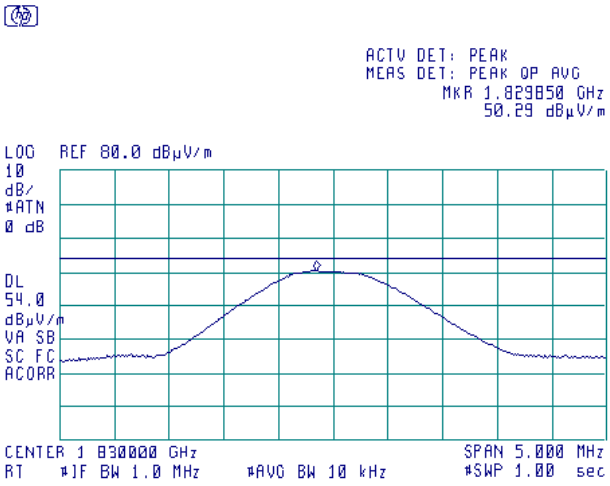




Plot 7.1.21 Radiated emission measurements at the second harmonic frequency at mid frequency

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

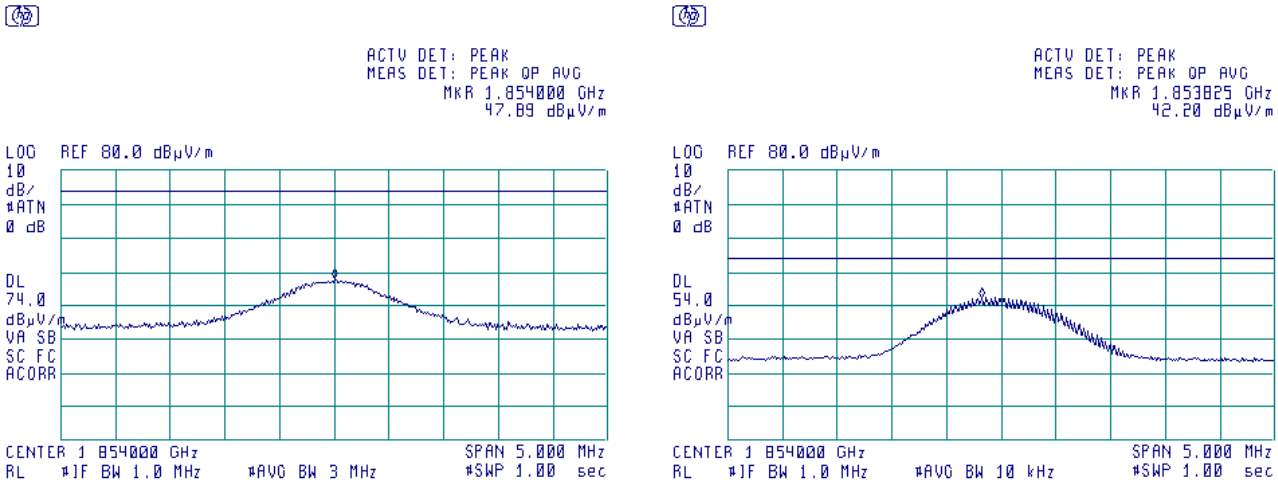




Test specification:	Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	15-Aug-14		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 47 %	Power Supply: 24 VDC
Remarks:			

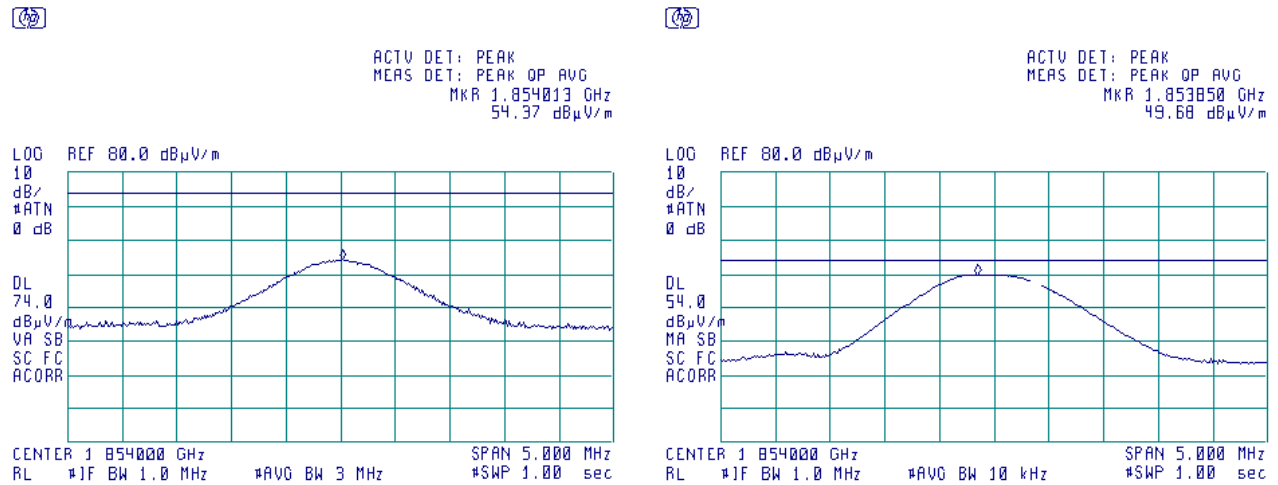
Plot 7.1.22 Radiated emission measurements at the second harmonic frequency at high frequency

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



Plot 7.1.23 Radiated emission measurements at the second harmonic frequency at high frequency

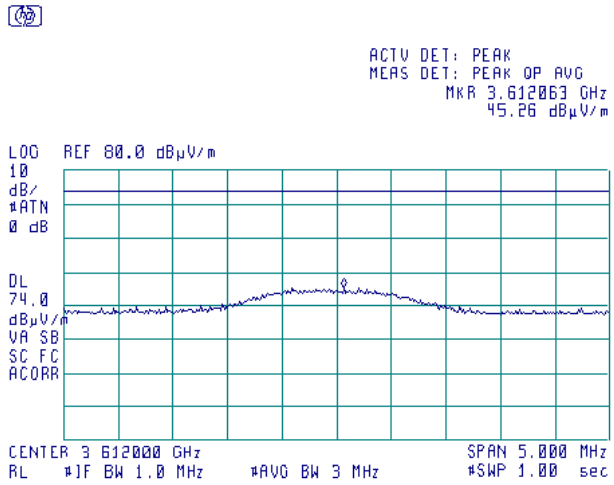
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal

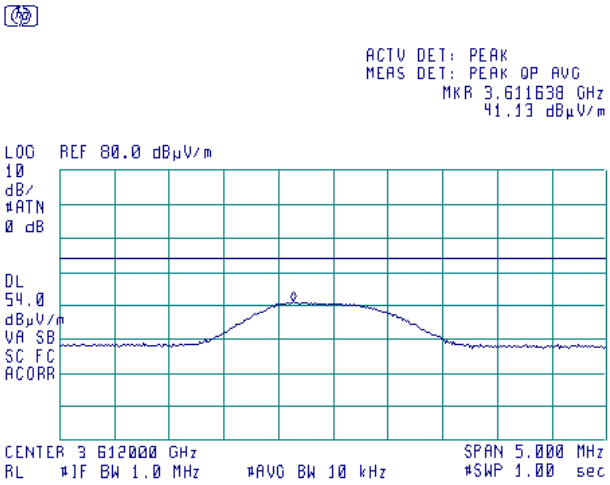


Test specification:	Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	15-Aug-14		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 47 %	Power Supply: 24 VDC
Remarks:			

Plot 7.1.24 Radiated emission measurements at the fourth harmonic frequency at low frequency

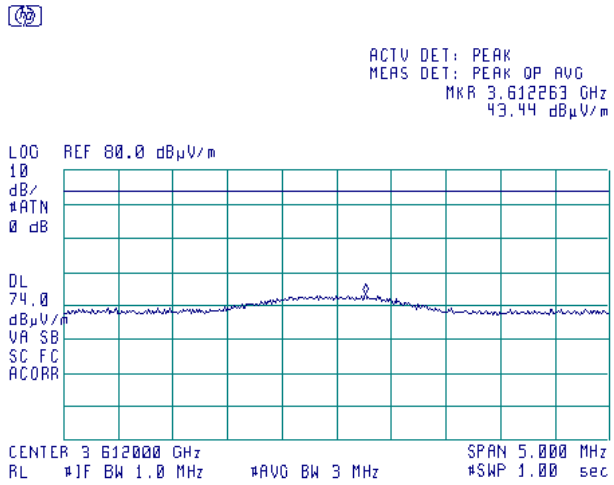
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical

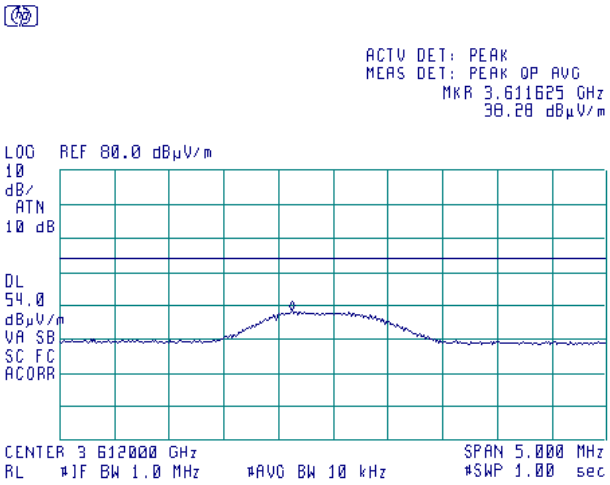




Plot 7.1.25 Radiated emission measurements at the fourth harmonic frequency at low frequency

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

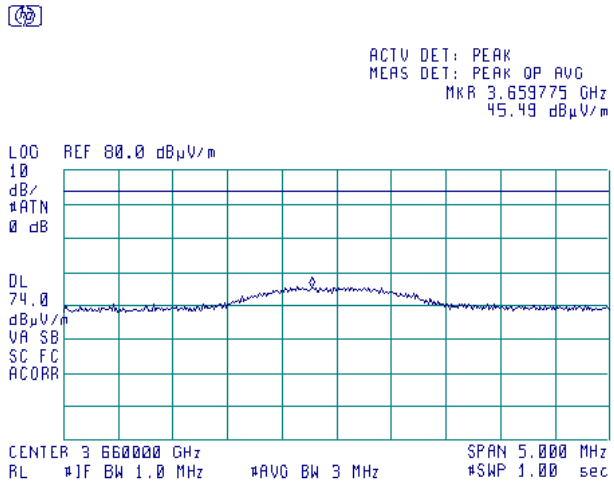


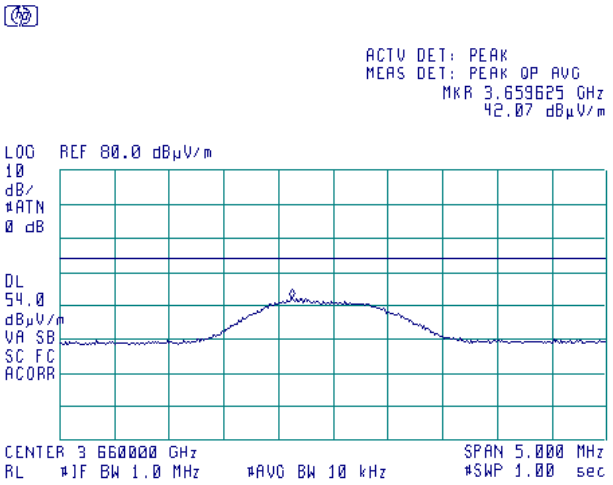


Test specification:	Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	15-Aug-14		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 47 %	Power Supply: 24 VDC
Remarks:			

Plot 7.1.26 Radiated emission measurements at the fourth harmonic frequency at mid frequency

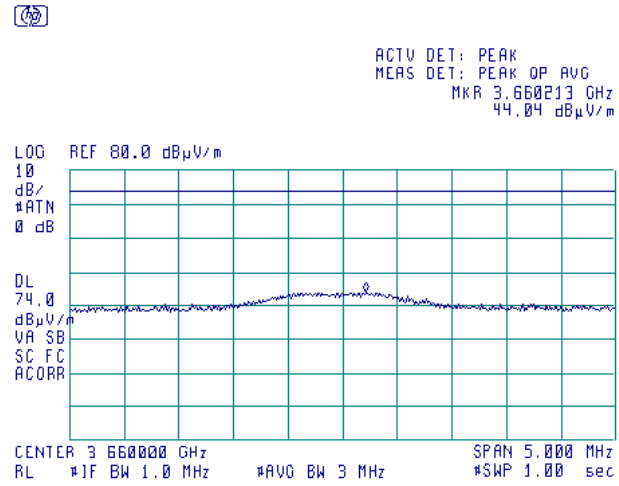
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical

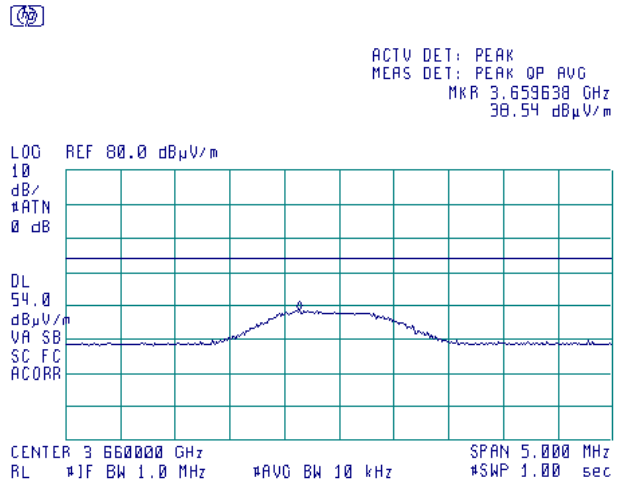




Plot 7.1.27 Radiated emission measurements at the fourth harmonic frequency at mid frequency

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

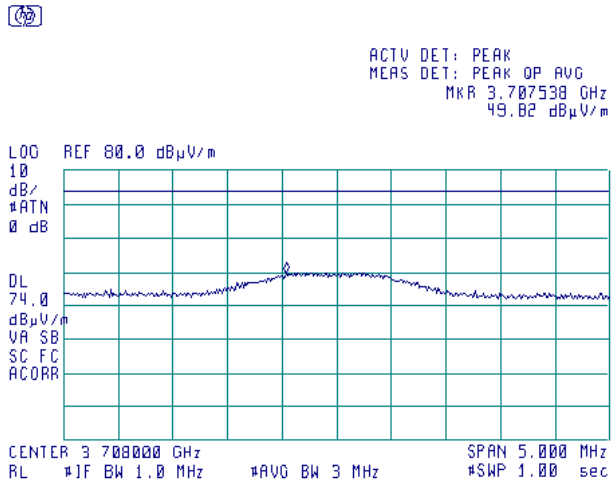


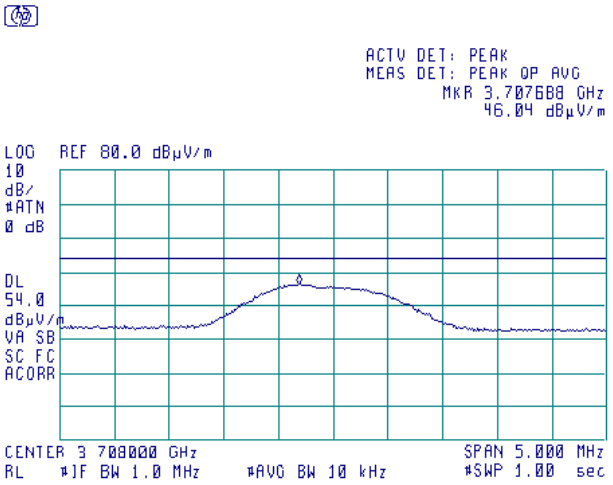


Test specification:	Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	15-Aug-14		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 47 %	Power Supply: 24 VDC
Remarks:			

Plot 7.1.28 Radiated emission measurements at the fourth harmonic frequency at high frequency

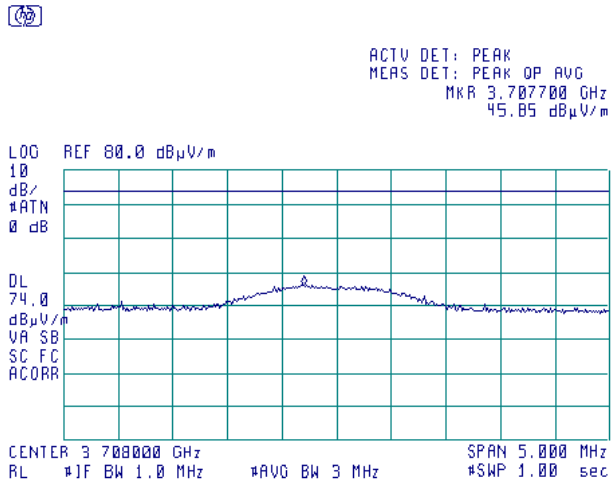
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical

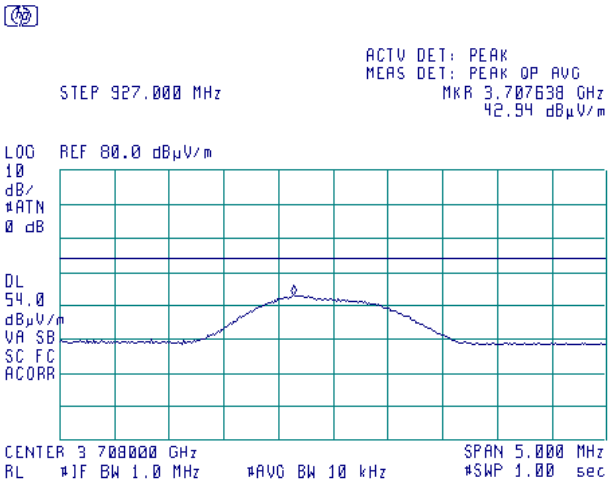




Plot 7.1.29 Radiated emission measurements at the fourth harmonic frequency at high frequency

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

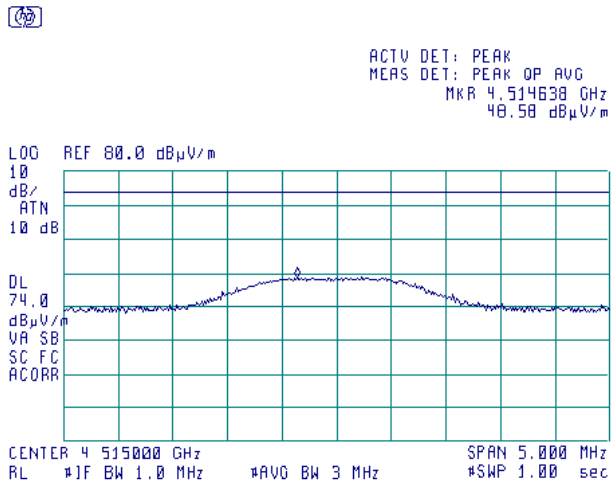


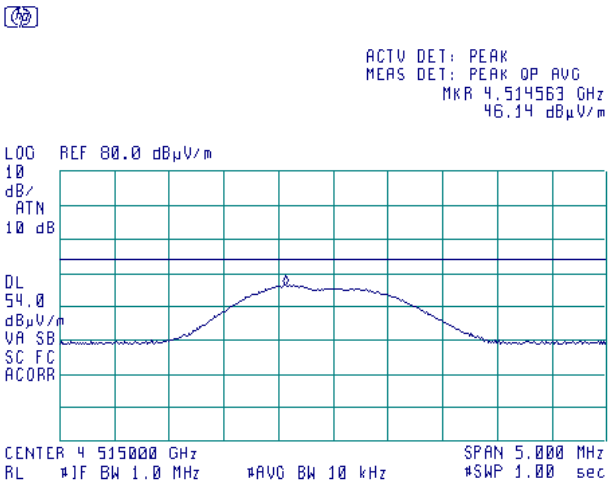


Test specification:	Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	15-Aug-14		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 47 %	Power Supply: 24 VDC
Remarks:			

Plot 7.1.30 Radiated emission measurements at the fifth harmonic frequency at low frequency

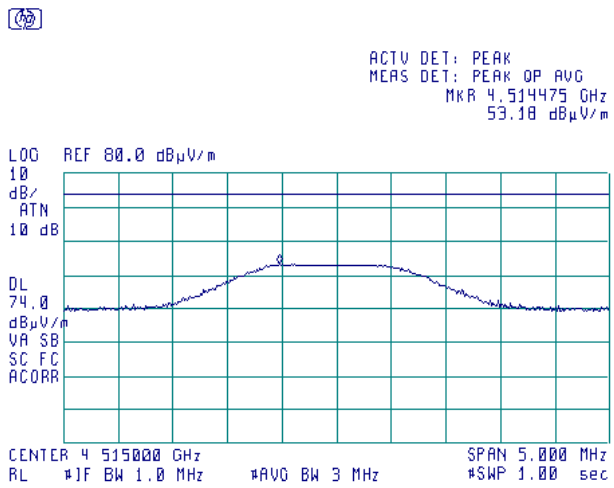
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical,

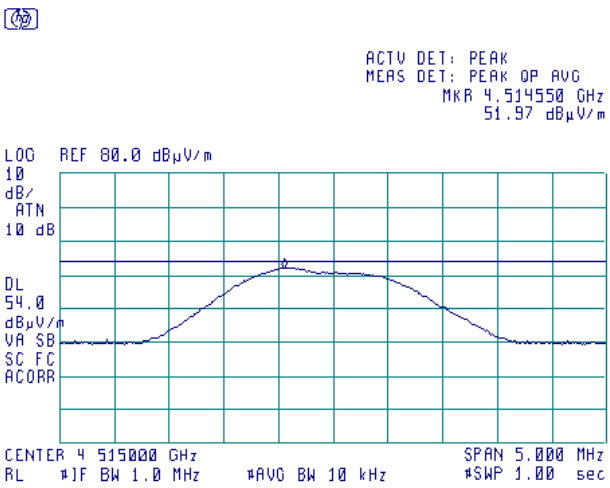




Plot 7.1.31 Radiated emission measurements at the fifth harmonic frequency at low frequency

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

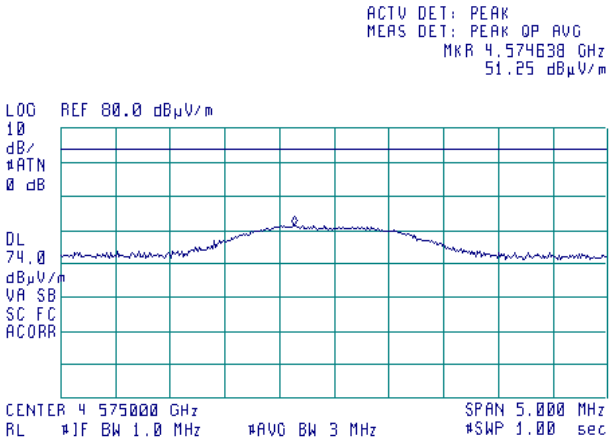


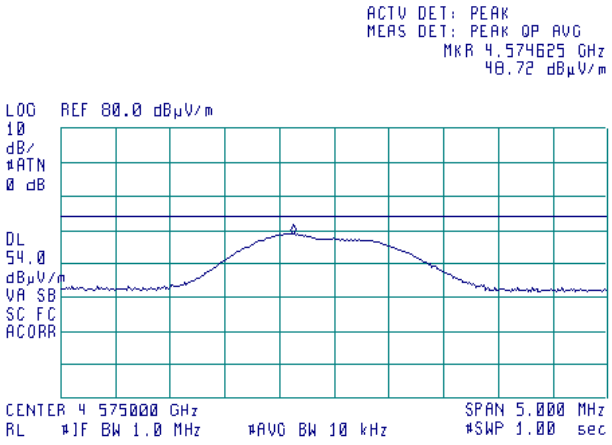


Test specification:	Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	15-Aug-14		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 47 %	Power Supply: 24 VDC
Remarks:			

Plot 7.1.32 Radiated emission measurements at the fifth harmonic frequency at mid frequency

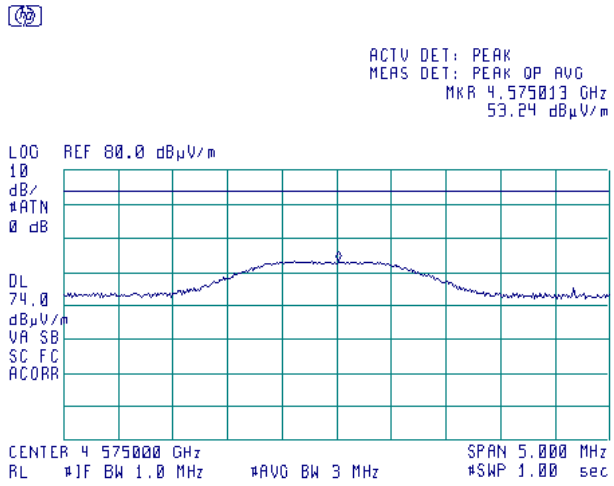
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical

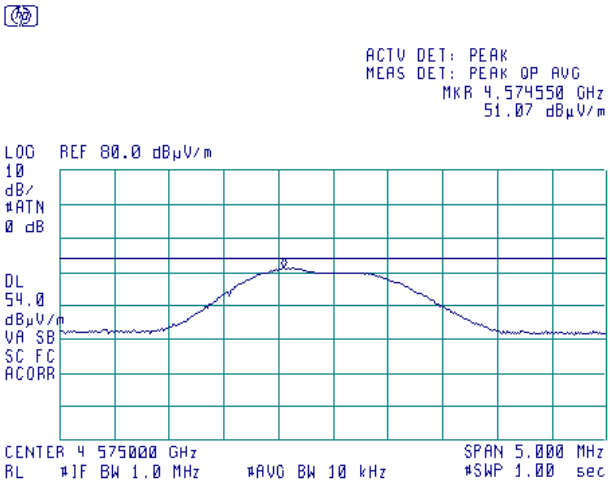




Plot 7.1.33 Radiated emission measurements at the fifth harmonic frequency at mid frequency

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

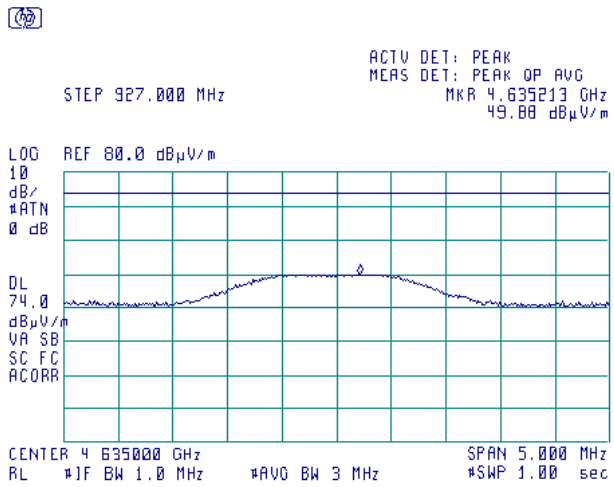


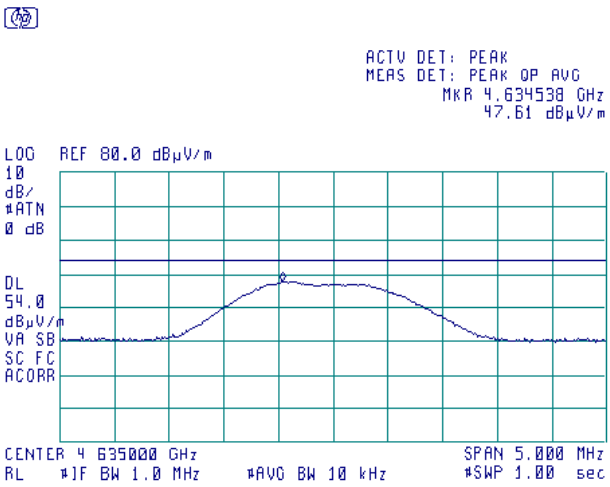


Test specification:	Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	15-Aug-14		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 47 %	Power Supply: 24 VDC
Remarks:			

Plot 7.1.34 Radiated emission measurements at the fifth harmonic frequency at high frequency

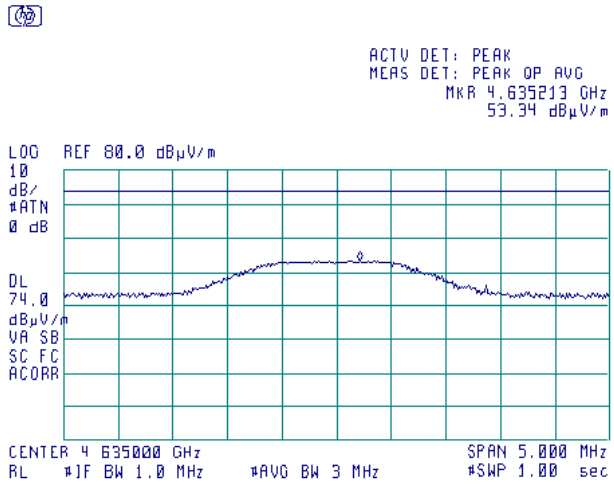
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical

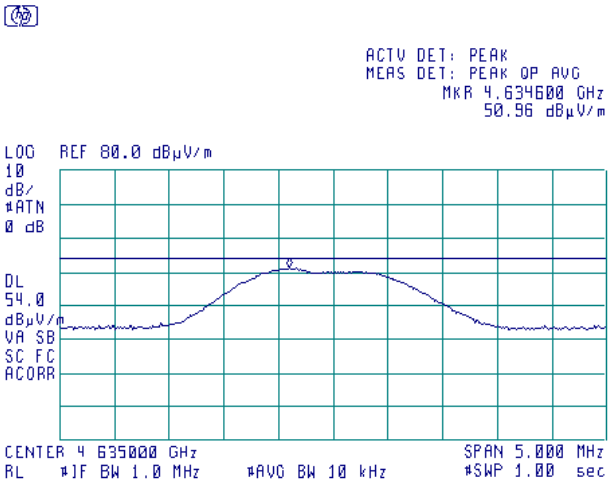




Plot 7.1.35 Radiated emission measurements at the fifth harmonic frequency at high frequency

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

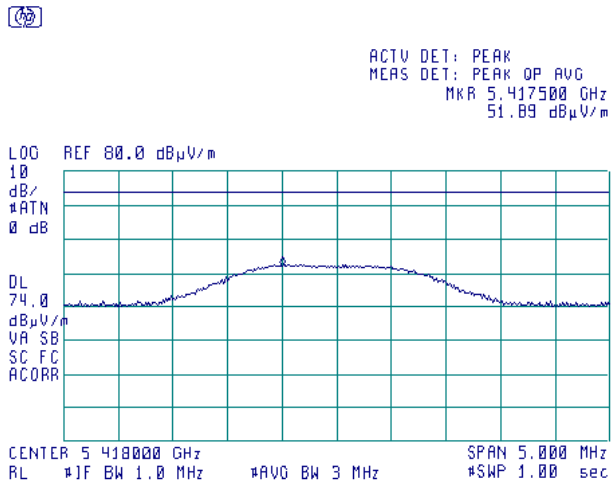


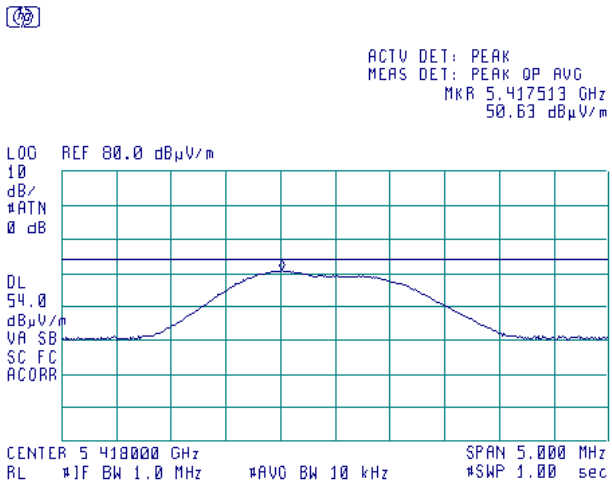


Test specification:	Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	15-Aug-14		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 47 %	Power Supply: 24 VDC
Remarks:			

Plot 7.1.36 Radiated emission measurements at the sixth harmonic at low frequency

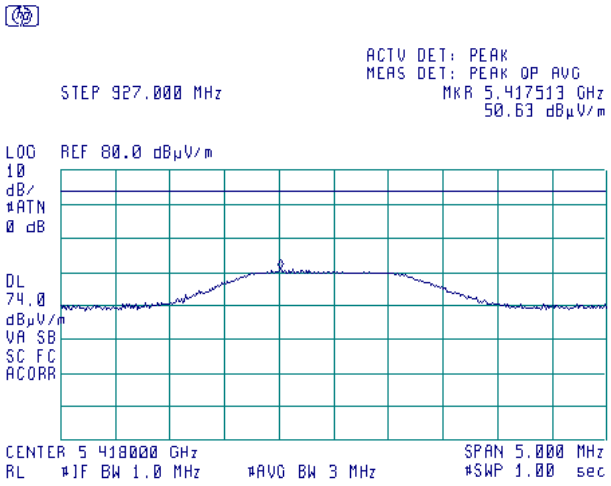
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical

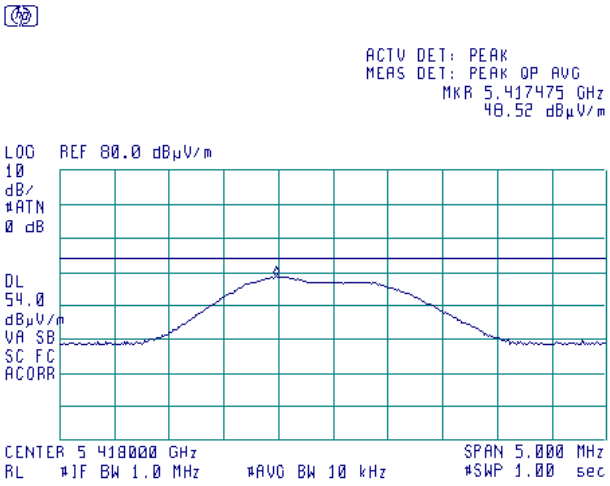




Plot 7.1.37 Radiated emission measurements at the sixth harmonic at low frequency

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

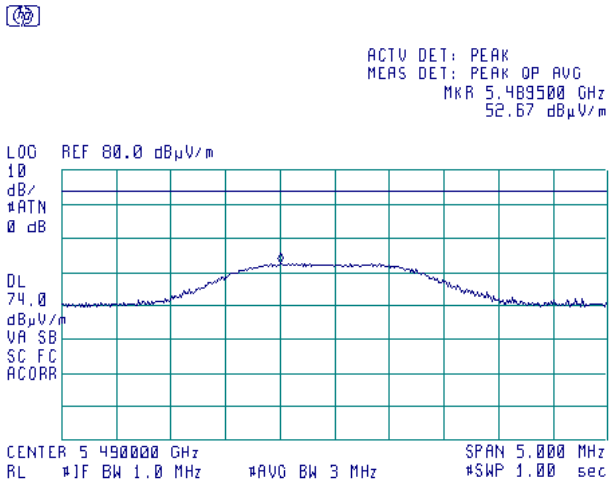


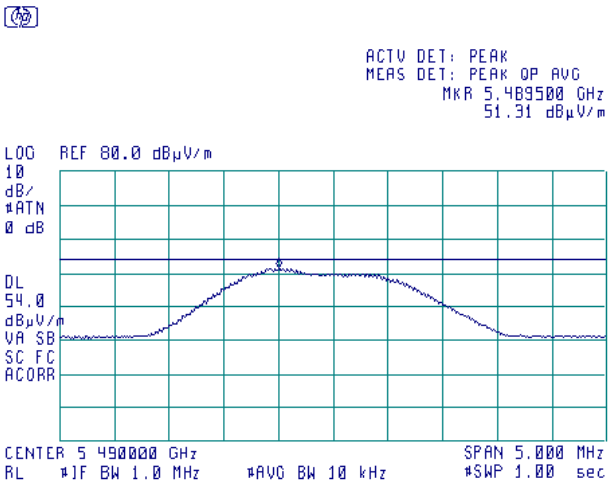


Test specification:	Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	15-Aug-14		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 47 %	Power Supply: 24 VDC
Remarks:			

Plot 7.1.38 Radiated emission measurements at the sixth harmonic at mid frequency

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

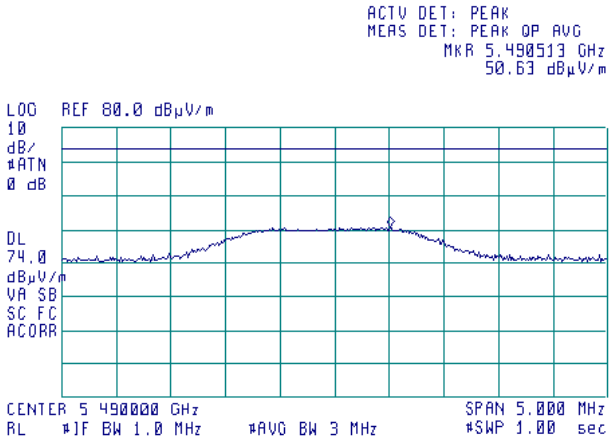


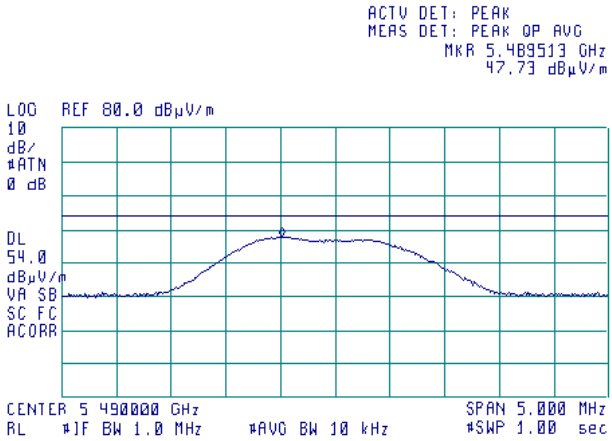


.

Plot 7.1.39 Radiated emission measurements at the sixth harmonic at mid frequency

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

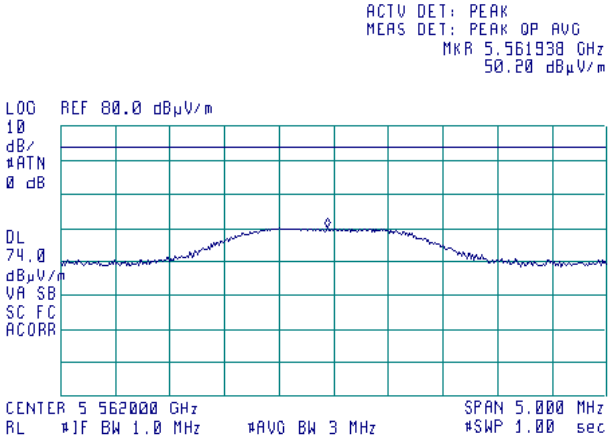


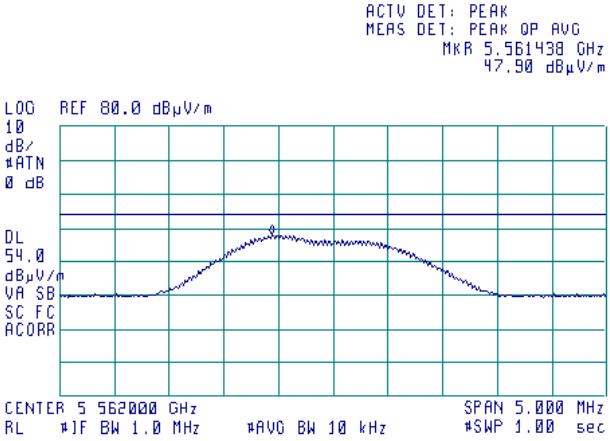


Test specification:	Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	15-Aug-14		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 47 %	Power Supply: 24 VDC
Remarks:			

Plot 7.1.40 Radiated emission measurements at the sixth harmonic at high frequency

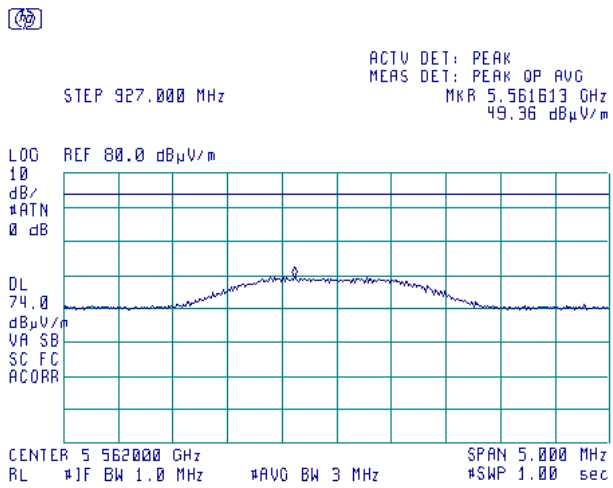
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical

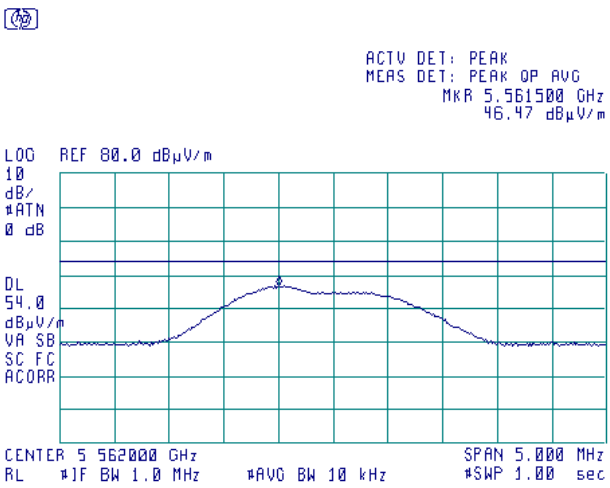




Plot 7.1.41 Radiated emission measurements at the sixth harmonic at high frequency

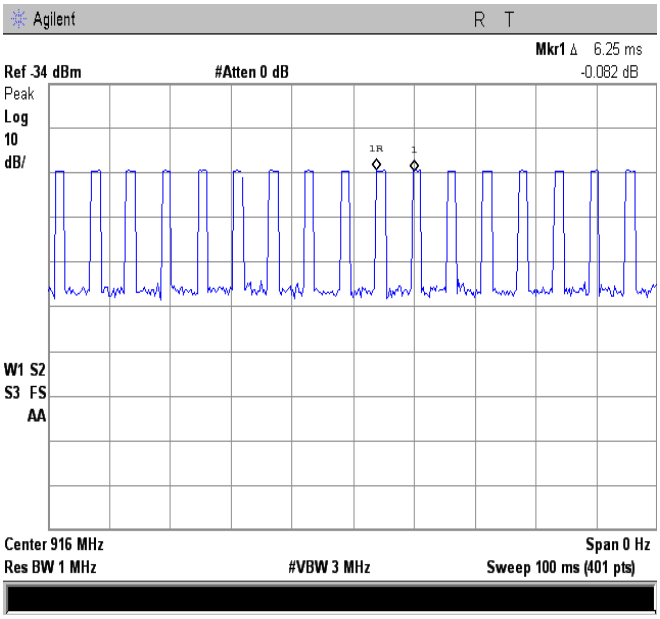
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal



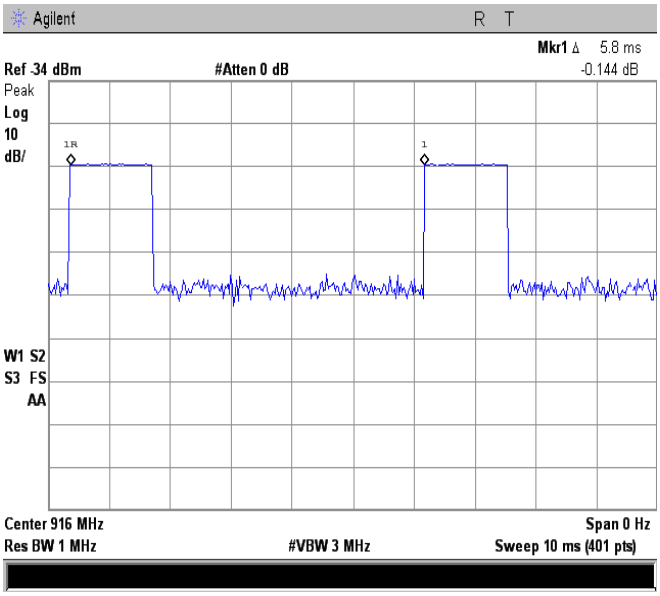


Test specification:	Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	15-Aug-14		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 47 %	Power Supply: 24 VDC
Remarks:			

Plot 7.1.42 Transmission pulse period

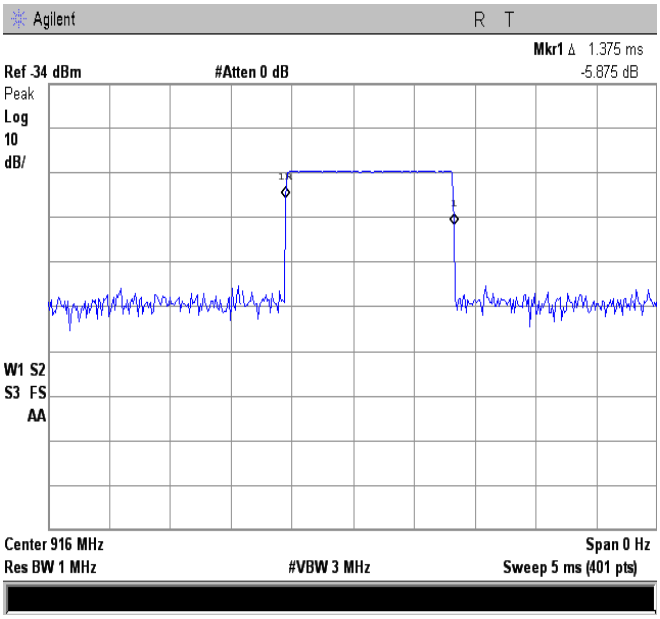


Plot 7.1.43 Transmission pulse period



Test specification:	Section 15.249(a)(d)/RSS-210, section A2.9, Field strength of emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	15-Aug-14		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 47 %	Power Supply: 24 VDC
Remarks:			

Plot 7.1.44 Transmission pulse duration



Test specification:	Section 15.249(d)/RSS-210, section A2.9, Band edge emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	13-Jul-14		
Temperature: 23 ºC	Air Pressure: 1009 hPa	Relative Humidity: 41 %	Power Supply: 24VDC
Remarks:			

7.2 Band edge emission

7.2.1 General

This test was performed to verify the EUT band edge emission including all associated side bands was attenuated at least 50 dB below the unmodulated carrier level or below the general spurious emission limit. Specification test limits are given in Table 7.2.1.

Table 7.2.1 Band edge emission limits

Frequency band, MHz	Field strength limit at 3 m, dBµV/m		Attenuation below carrier, dBc
	Peak	QP	
902.000 - 928.000	NA	46.0	50

7.2.2 Test procedure

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

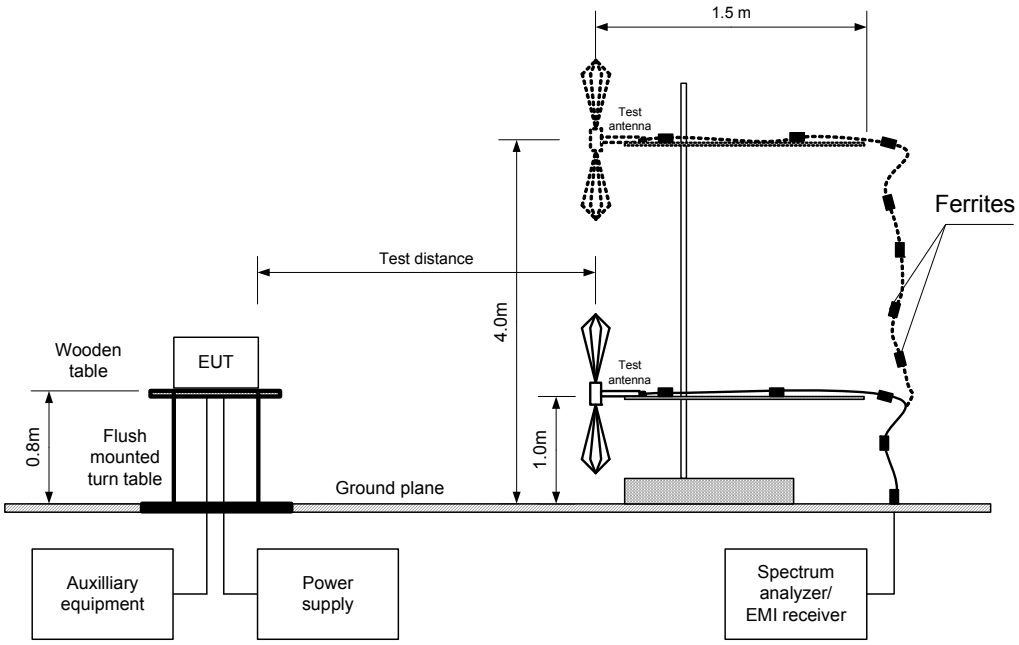
7.2.2.2 The spectrum analyzer frequency span was set to capture all major modulation sidebands of emission and sweep time was set sufficiently slow to ensure peak measurements. Spectrum analyzer was set in peak hold mode and time sufficient for trace stabilization was allowed.

7.2.2.3 The frequency of modulation envelope points beyond which power level drops below the band edge emission limit was measured.

7.2.2.4 The test results were recorded in Table 7.2.2 and shown in the associated plots.

Test specification:	Section 15.249(d)/RSS-210, section A2.9, Band edge emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	13-Jul-14		
Temperature: 23 ºC	Air Pressure: 1009 hPa	Relative Humidity: 41 %	Power Supply: 24VDC
Remarks:			

Figure 7.2.1 Band edge emission measurement set up



Test specification:	**Section 15.249(d)/RSS-210, section A2.9, Band edge emissions**		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	13-Jul-14		
Temperature: 23 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 41 %	**Power Supply:** 24VDC
Remarks:			

Table 7.2.2 Band edge emission test results

OPERATING FREQUENCY RANGE: 902-928 MHz
DETECTOR USED: Peak hold
RESOLUTION BANDWIDTH: 120 kHz
VIDEO BANDWIDTH: 300 kHz
MODULATION: GFSK
BIT RATE: 160 kbps
TRANSMITTER OUTPUT POWER SETTINGS: 1 dBm

Modulation envelope		**Measured peak emission, dBµV/m**	**Measured QP emission, dBµV/m**	**QP limit, dBµV/m**	**Margin, dB ***	**Verdict**
Edge	**Frequency, MHz**					
Low	901.995	41.86	NA	46.0	-4.14	Pass
High	928.030	40.07	NA	46.0	-5.93	Pass

* - Margin = measured value– limit

Reference numbers of test equipment used

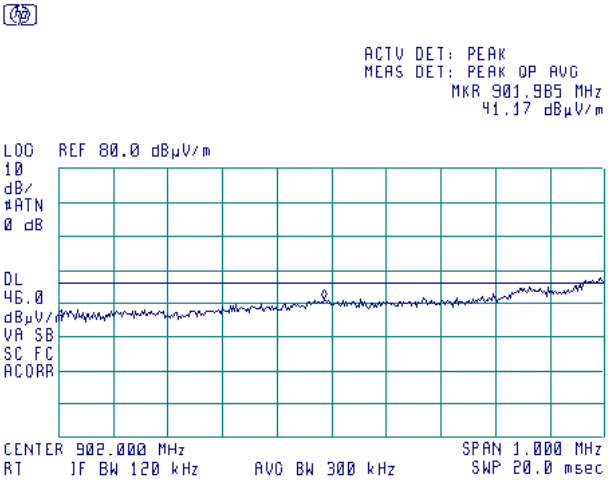
HL 0521	HL 0604	HL 4353	HL 4722				

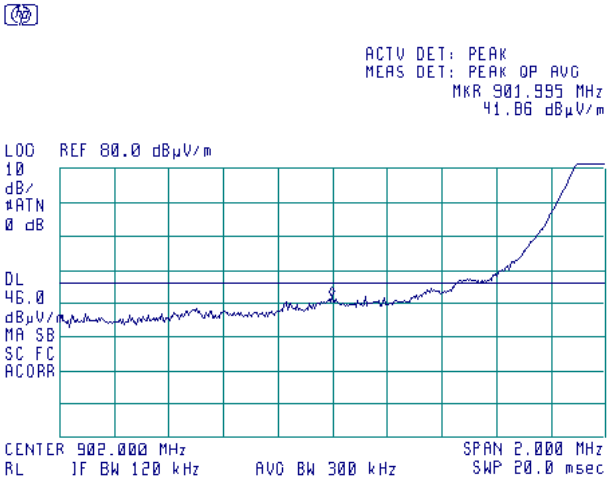
Full description is given in Appendix A.

Test specification:	Section 15.249(d)/RSS-210, section A2.9, Band edge emissions		
Test procedure:	ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	13-Jul-14		
Temperature: 23 ºC	Air Pressure: 1009 hPa	Relative Humidity: 41 %	Power Supply: 24VDC
Remarks:			

Plot 7.2.1 Low band edge emission test result at low frequency

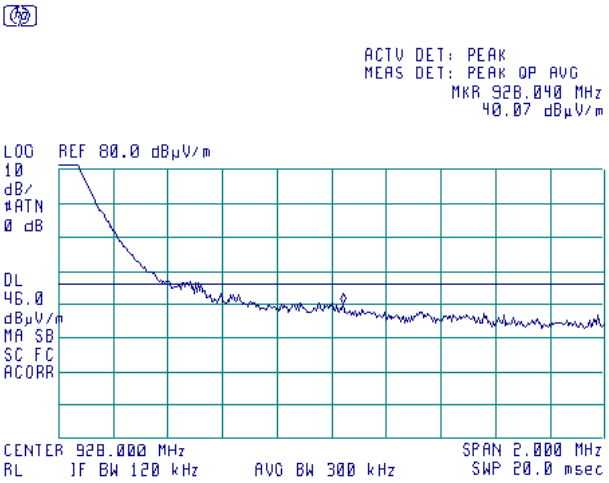
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Vertical and Horizontal

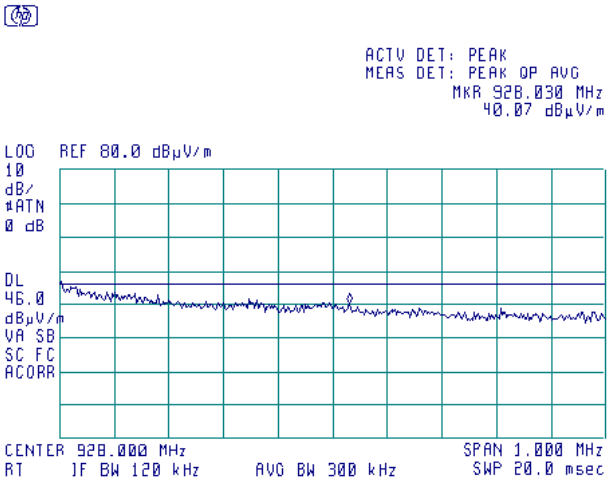




Plot 7.2.2 High band edge emission test result at high frequency

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





Test specification:	Section 15.207(a)/RSS-Gen, section 7.2.4, Conducted emission		
Test procedure:	ANSI C63.4, Section 13.1.3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	04-Aug-14		
Temperature: 24 ºC	Air Pressure: 1008 hPa	Relative Humidity: 47 %	Power Supply: 120 VAC
Remarks:			

7.3 Conducted emissions

7.3.1 General

This test was performed to measure common mode conducted emissions at the mains power port. Specification test limits are given in Table 7.3.1.

Table 7.3.1 Limits for conducted emissions

Frequency, MHz	Class B limit, dB(μV)	
	QP	AVRG
0.15 - 0.5	66 - 56*	56 - 46*
0.5 - 5.0	56	46
5.0 - 30	60	50

* The limit decreases linearly with the logarithm of frequency.

7.3.2 Test procedure

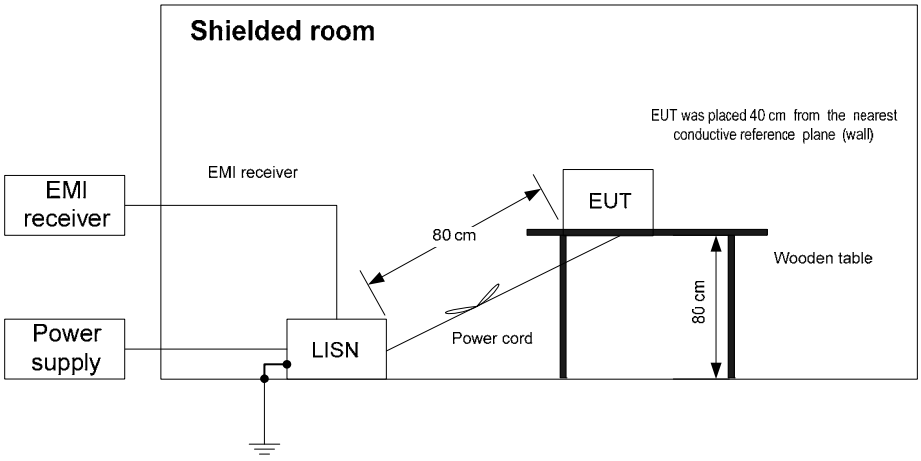
7.3.2.1 The EUT was set up as shown in Figure 7.3.1 and associated photographs, energized and the performance check was conducted.

7.3.2.2 The measurements were performed at power terminals with the LISN, connected to a spectrum analyzer in the frequency range referred to in Table 7.3.2. Unused coaxial connector of the LISN was terminated with 50 Ohm. Quasi-peak and average detectors were used throughout the testing.

7.3.2.3 The position of the device cables was varied to determine maximum emission level.

7.3.2.4 The worst test results (the lowest margins) were recorded in Table 7.3.2 and shown in the associated plots.

Figure 7.3.1 Setup for conducted emission measurements, table-top equipment



Test specification:	**Section 15.207(a)/RSS-Gen, section 7.2.4, Conducted emission**		
Test procedure:	ANSI C63.4, Section 13.1.3		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	04-Aug-14		
Temperature: 24 ºC	**Air Pressure:** 1008 hPa	**Relative Humidity:** 47 %	**Power Supply:** 120 VAC
Remarks:			

Table 7.3.2 Conducted emission test results

LINE: AC mains
EUT OPERATING MODE: Transmit
EUT SET UP: TABLE-TOP
TEST SITE: SHIELDED ROOM
DETECTORS USED: PEAK / QUASI-PEAK / AVERAGE
FREQUENCY RANGE: 150 kHz - 30 MHz
RESOLUTION BANDWIDTH: 9 kHz

Frequency, MHz	Peak emission, dB(μV)	Quasi-peak			Average			Line ID	Verdict
		Measured emission, dB(μV)	Limit, dB(μV)	Margin, dB*	Measured emission, dB(μV)	Limit, dB(μV)	Margin, dB*		
0.165475	57.59	51.63	65.25	-13.62	33.10	55.25	-22.15	L1	Pass
0.192075	51.58	44.99	63.96	-18.97	31.00	53.96	-22.96		
0.469183	43.53	41.15	56.58	-15.43	30.18	46.58	-16.40		
0.880465	39.05	31.78	56.00	-24.22	19.65	46.00	-26.35		
1.700000	38.52	32.12	56.00	-23.88	17.70	46.00	-28.30		
4.500000	34.29	25.86	56.00	-30.14	13.39	46.00	-32.61		
0.171715	54.35	47.68	64.94	-17.26	23.71	54.94	-31.23	L2	Pass
0.191405	51.55	44.94	63.98	-19.04	25.56	53.98	-28.42		
0.472115	42.98	40.28	56.52	-16.24	28.95	46.52	-17.57		
1.014460	33.25	26.19	56.00	-29.81	12.95	46.00	-33.05		
10.549113	36.40	29.36	60.00	-30.64	17.08	50.00	-32.92		
12.662558	36.70	27.23	60.00	-32.77	15.79	50.00	-34.21		

*- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

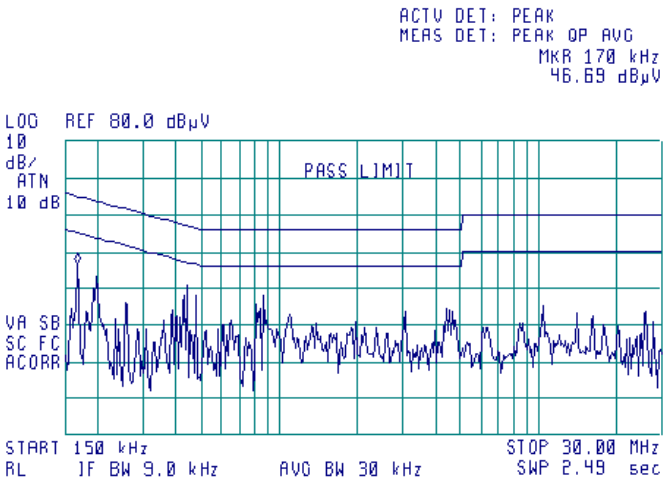
HL 0787	HL 1513	HL 2888	HL 3612				

Full description is given in Appendix A.

Test specification:	Section 15.207(a)/RSS-Gen, section 7.2.4, Conducted emission		
Test procedure:	ANSI C63.4, Section 13.1.3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	04-Aug-14		
Temperature: 24 ºC	Air Pressure: 1008 hPa	Relative Humidity: 47 %	Power Supply: 120 VAC
Remarks:			

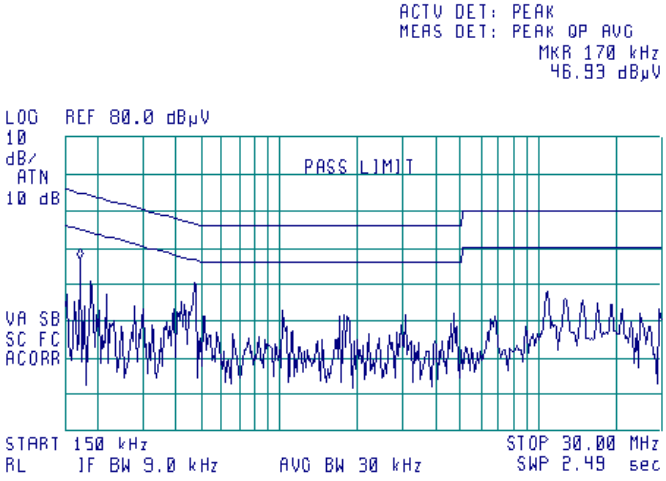
Plot 7.3.1 Conducted emission measurements

LINE: L1
EUT OPERATING MODE: Transmit
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Plot 7.3.2 Conducted emission measurements

LINE: L2
EUT OPERATING MODE: Transmit
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Test specification:	Section 15.203 / RSS-Gen, section 7.1.2, Antenna requirement		
Test procedure:	Visual inspection / supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Aug-14		
Temperature: 24 ºC	Air Pressure: 1010 hPa	Relative Humidity: 44 %	Power Supply: 24 VDC
Remarks:			

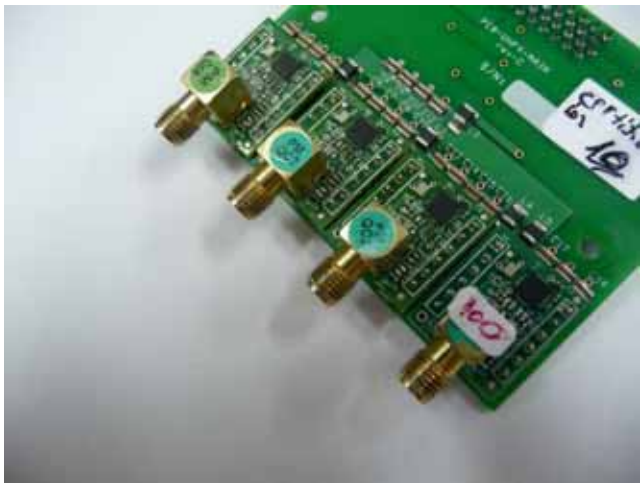
7.4 Antenna requirements

The EUT was verified for compliance with antenna requirements. A transmitter shall be designed to ensure that no antenna other than that furnished by the responsible party will be used with the device. It may be either permanently attached or employs a unique antenna connector for every antenna proposed for use with the EUT. This requirement does not apply to professionally installed transmitters.
The rationale for compliance with the above requirements was either visual inspection results or supplier declaration. The summary of results is provided in Table 7.4.1.

Table 7.4.1 Antenna requirements

Requirement	Rationale	Verdict
The transmitter antenna is permanently attached	NA	Comply
The transmitter employs a unique antenna connector	Visual inspection	
The transmitter requires professional installation	NA	

Photograph 7.4.1 Antenna connector



Test specification:	Section 15.215(c) / RSS-Gen, Section 4.6, Occupied bandwidth		
Test procedure:	ANSI C63.4, Section 13.1.7		
Test mode:	Compliance	Verdict:	PASS
Date(s):	13-Aug-14		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 44 %	Power Supply: 24 VDC
Remarks:			

7.5 Occupied bandwidth test

7.5.1 General

This test was performed to verify that the 20 dB bandwidth of the emissions was contained within the standard specified frequency band according to FCC §15.215 requirements. Specification test limits are given in Table 7.5.1.

Table 7.5.1 Occupied bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, dBc
902 - 928	20.0
2400 – 2483.5	
5725 – 5875	
24000 – 24250	

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

7.5.2 Test procedure

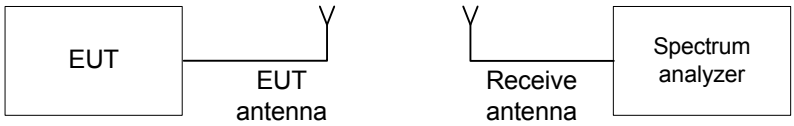
7.5.2.1 The EUT was set up as shown in Figure 7.5.1, energized and its proper operation was checked.

7.5.2.2 The spectrum analyzer sweep time and bandwidth were set to capture all major modulation sidebands of emission and sweep time was set sufficiently slow to ensure peak measurements. Spectrum analyzer was set in peak hold mode and time sufficient for trace stabilization was allowed.

7.5.2.3 The peak of emission was measured. The transmitter occupied bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.5.2 and associated plot.

7.5.2.4 Modulation bandwidth was calculated by adding of the negative frequency drift to the lower measured frequency and the positive frequency drift to the higher measured frequency. The obtained modulation bandwidth was verified to be within the allowed frequency range.

Figure 7.5.1 Occupied bandwidth test setup



Test specification:	**Section 15.215(c) / RSS-Gen, Section 4.6, Occupied bandwidth**		
Test procedure:	ANSI C63.4, Section 13.1.7		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	13-Aug-14		
Temperature: 24 ºC	**Air Pressure:** 1005 hPa	**Relative Humidity:** 44 %	**Power Supply:** 24 VDC
Remarks:			

Table 7.5.2 Occupied bandwidth test results

ASSIGNED FREQUENCY BAND	902-928 MHz
DETECTOR USED:	Peak hold
RESOLUTION BANDWIDTH:	100 kHz
VIDEO BANDWIDTH:	300 kHz
MODULATION ENVELOPE REFERENCE POINTS:	20 dBc
MODULATION:	GFSK

Band edge	Cross point frequency, MHz	Frequency drift, kHz		Modulation band edge, MHz	Assigned band edge, MHz	Verdict
		Negative	Positive			
Low	902.7125	NA	NA	902.7125	902	Pass
High	927.3400	NA	NA	927.3400	928	Pass

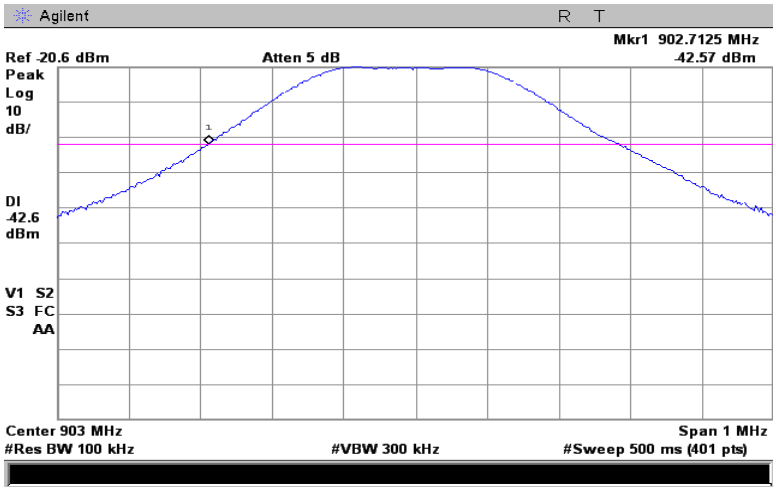
Reference numbers of test equipment used

HL 2909								

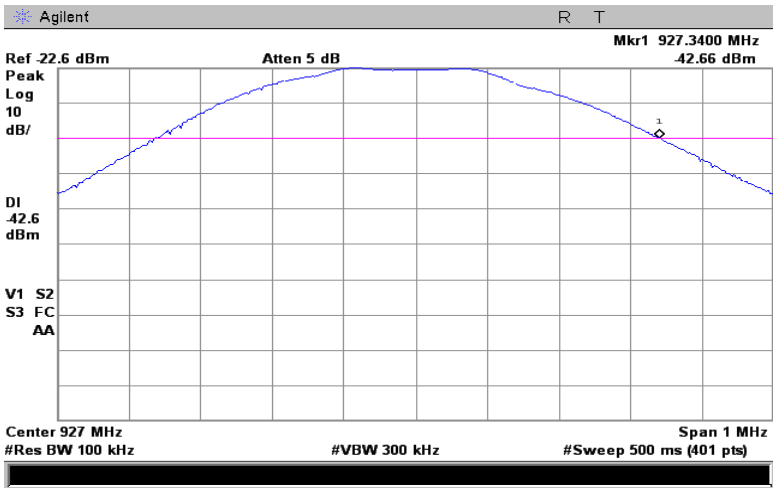
Full description is given in Appendix A.

Test specification:	Section 15.215(c) / RSS-Gen, Section 4.6, Occupied bandwidth		
Test procedure:	ANSI C63.4, Section 13.1.7		
Test mode:	Compliance	Verdict:	PASS
Date(s):	13-Aug-14		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 44 %	Power Supply: 24 VDC
Remarks:			

Plot 7.5.1 Cross point low frequency test result

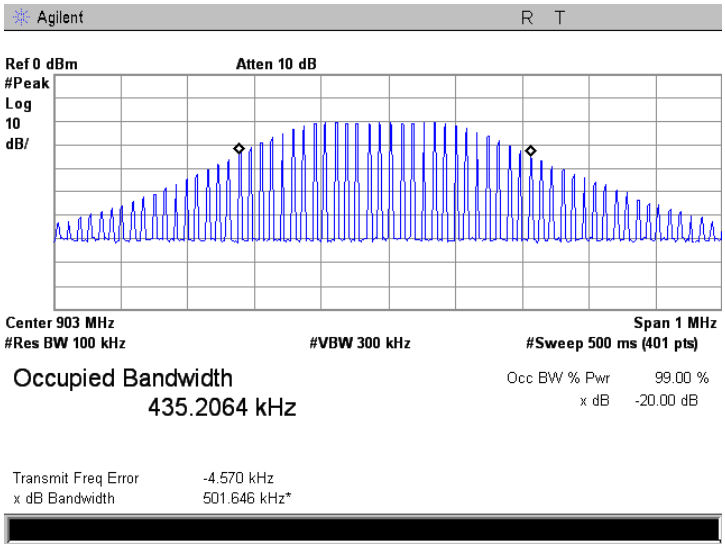


Plot 7.5.2 Cross point high frequency test result

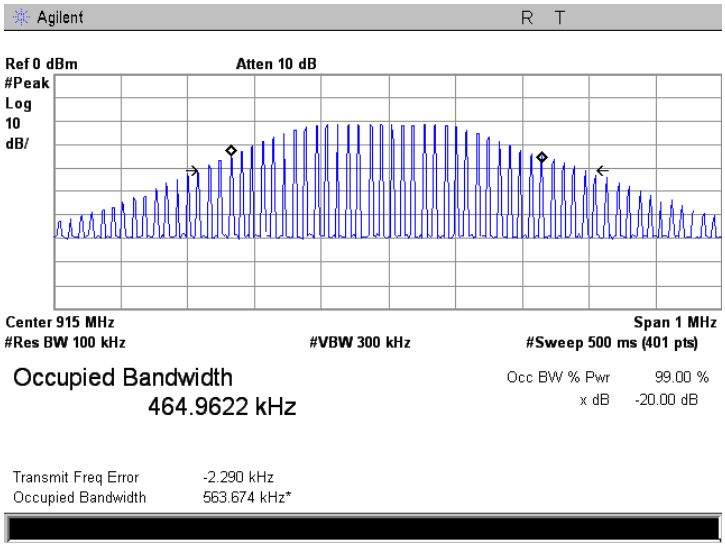


Test specification:	Section 15.215(c) / RSS-Gen, Section 4.6, Occupied bandwidth		
Test procedure:	ANSI C63.4, Section 13.1.7		
Test mode:	Compliance	Verdict:	PASS
Date(s):	13-Aug-14		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 44 %	Power Supply: 24 VDC
Remarks:			

Plot 7.5.3 Occupied bandwidth test result at low frequency

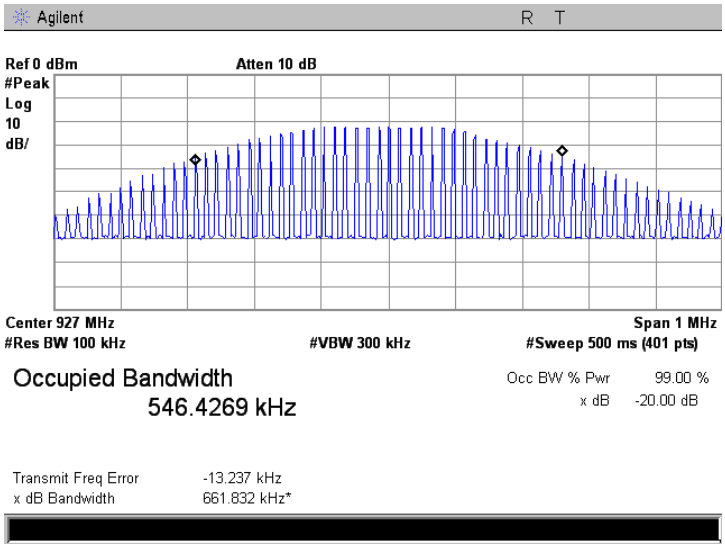


Plot 7.5.4 Occupied bandwidth test result at mid frequency



Test specification:	Section 15.215(c) / RSS-Gen, Section 4.6, Occupied bandwidth		
Test procedure:	ANSI C63.4, Section 13.1.7		
Test mode:	Compliance	Verdict:	PASS
Date(s):	13-Aug-14		
Temperature: 24 ºC	Air Pressure: 1005 hPa	Relative Humidity: 44 %	Power Supply: 24 VDC
Remarks:			

Plot 7.5.5 Occupied bandwidth test result at high frequency



8 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	21-Jan-14	21-Jan-15
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	28-Oct-13	28-Oct-14
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	22-May-14	22-May-15
0787	Transient Limiter 9 kHz-200 MHz	Hewlett Packard	11947A	3107A018 77	13-Oct-13	13-Oct-14
1513	Cable RF, 8 m, BNC/BNC	Belden	M17/167 MIL-C-17	1513	05-Nov-13	05-Nov-14
2432	Antenna, Double-Ridged Waveguide Horn 1-18 GHz	EMC Test Systems	3115	00027177	03-Jan-14	03-Jan-15
2888	LISN Two-line V-Network 50 Ohm / 50 uH + 5 Ohm, 16A, MIL STD 461E, CISPR 16-1	Rolf Heine	NNB-2/16Z	02/10018	24-Mar-14	24-Mar-15
2909	Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz	Agilent Technologies	E4407B	MY414447 62	23-Dec-13	23-Dec-14
3531	Amplifier, low noise, 2 to 8 GHz	Quinstar Technology	QLJ-02084040 -J0	111590020 02	23-Dec-13	23-Dec-14
3612	Cable RF, 17.5 m, N type-N type	Teldor	RG-214/U	NA	05-Dec-13	05-Dec-14
4114	Antenna, Double-Ridged Waveguide Horn, 1-18 GHz	ETS Lindgren	3117	00123515	27-Dec-13	27-Dec-14
4353	Low Loss Armored Test Cable, DC - 18 GHz, 6.2 m, N type-M/N type-M	MegaPhase	NC29-N1N1-244	12025101 003	16-Mar-14	16-Mar-15
4722	Low Loss Armored Test Cable, DC - 18 GHz, 6.2 m, N type-M/N type-M	MegaPhase	NC29-N1N1-244	51228701 001	26-Aug-14	26-Aug-15

9 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Conducted emissions with LISN	9 kHz to 150 kHz: ± 3.9 dB 150 kHz to 30 MHz: ± 3.8 dB
Radiated emissions at 3 m measuring distance Horizontal polarization Vertical polarization	 Biconilog antenna: ± 5.3 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.3 dB Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 6.0 dB Biconical antenna: ± 5.7 dB Log periodic antenna: ± 6.0 dB Double ridged horn antenna: ± 6.0 dB
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
Duty cycle, timing (Tx ON / OFF) and average factor measurements	± 1.0 %
Occupied bandwidth	± 8.0 %

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.

10 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 numbers IC 2186A-1 for OATS, IC 2186A-2 for anechoic chamber, IC 2186A-3 for full-anechoic chamber for RE measurements above 1 GHz), certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-1082 for anechoic chamber, G-27 for full-anechoic chamber for RE measurements above 1 GHz, 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 US1003.

Address: P.O. Box 23, Binyamina 30500, Israel.
Telephone: +972 4628 8001
Fax: +972 4628 8277
e-mail: mail@hermonlabs.com
website: www.hermonlabs.com

Person for contact: Mr. Alex Usoskin, CEO.

11 APPENDIX D Specification references

FCC 47CFR part 15: 2013	Radio Frequency Devices
ANSI C63.2: 1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications
ANSI C63.4: 2003	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
RSS-210 Issue 8: 2010	Low Power Licence- Exempt Radiocommunication Devices
RSS-Gen Issue 3: 2010	General Requirements and Information for the Certification of Radiocommunication Equipment
ICES-003 issue 5:2012	Information Technology Equipment (ITE) – Limits and methods of measurement

12 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 intensity 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 guide horn antenna
Model 3115, serial number: 00027177, HL 2432

Frequency, MHz	Antenna factor. dB(1/m)
1000.0	24.7
1500.0	25.7
2000.0	27.8
2500.0	28.9
3000.0	30.7
3500.0	31.8
4000.0	33.0
4500.0	32.8
5000.0	34.2
5500.0	34.9
6000.0	35.2
6500.0	35.4
7000.0	36.3
7500.0	37.3
8000.0	37.5
8500.0	38.0
9000.0	38.3
9500.0	38.3
10000.0	38.7
10500.0	38.7
11000.0	38.9
11500.0	39.5
12000.0	39.5
12500.0	39.4
13000.0	40.5
13500.0	40.8
14000.0	41.5
14500.0	41.3
15000.0	40.2
15500.0	38.7
16000.0	38.5
16500.0	39.8
17000.0	41.9
17500.0	45.8
18000.0	49.1

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).

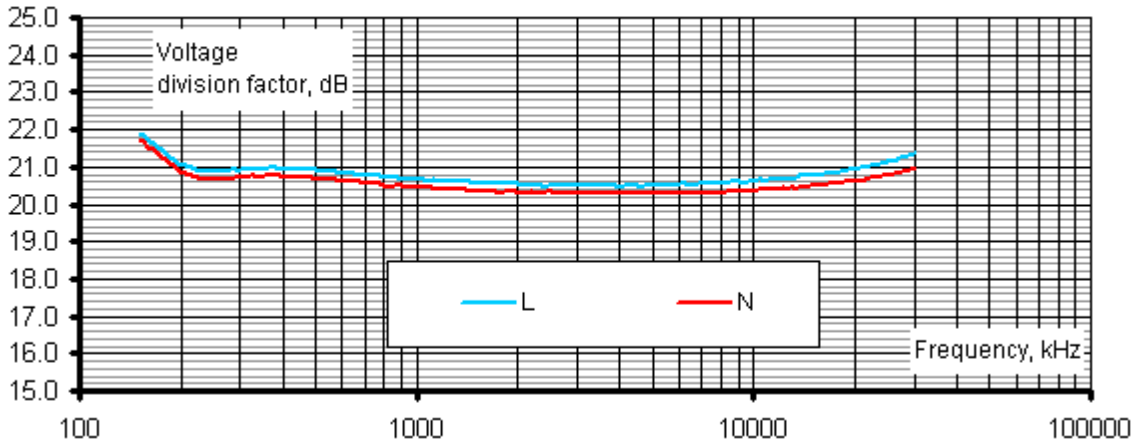
Antenna factor
Double-ridged waveguide horn antenna
ETS Lindgren, Model 3117, serial number: 00123515, HL 4114

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)

Correction factor
Line impedance stabilization network
Model NNB-2/16Z, Rolf Heine, HL 2888

Frequency, kHz	Correction factor, dB	
	L	N
150	21.92	21.74
170	21.52	21.36
200	21.06	20.85
250	20.88	20.68
300	20.92	20.70
350	20.96	20.77
400	20.96	20.74
500	20.92	20.69
600	20.85	20.63
700	20.78	20.58
800	20.73	20.52
900	20.68	20.50
1000	20.67	20.45
1200	20.61	20.43
1500	20.56	20.33
2000	20.54	20.32
2500	20.51	20.33
3000	20.53	20.29
4000	20.46	20.30
5000	20.53	20.33
7000	20.54	20.32
10000	20.62	20.36
15000	20.78	20.49
20000	20.94	20.63
30000	21.37	20.95



Cable loss
Cable coaxial, RG-214/U, N type-N type, 17 m
Teldor, HL 3612

Frequency, MHz	Cable loss, dB
0.1	0.05
0.5	0.07
1	0.10
3	0.22
5	0.29
10	0.39
30	0.68
50	0.90
100	1.27
150	1.58
200	1.80
250	2.12
300	2.36
350	2.60
400	2.82
450	2.99
500	3.23
550	3.40
600	3.56
650	3.71
700	3.90
750	4.04
800	4.23
850	4.39
900	4.55
950	4.65
1000	4.79

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 51228701 001
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		

13 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
A/m	ampere per meter
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
OATS	open area test site
Ω	Ohm
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

END OF TEST REPORT

14 APPENDIX G Manufacturer's declaration of identity

Gate Exciter GPRS - Declaration of identity:

We declare that the Gate Exciter GPRS is identical to the following products, with less hardware functions:

Hardware function	GATE EXCITER GPRS (tested device)	BASE STATION (identical)	GATE LOCATOR (identical)	4 Channel Exciter (identical)
GENERAL USE RELAY	8	4	8	8
DIGITAL INPUTS	8	4	8	8
GENERAL USE OUTPUT	8	4	8	8
GPRS	includes	includes	none	none
LF antenna port	4	None (software disable)	4	4
UHF1	Rx	software disable	Rx	Rx
UHF2	Tx	software disable	Tx	Tx
UHF3	Rx\Tx with tamper tag	Rx\Tx with tamper tag	Rx\Tx with tamper tag	Rx\Tx with tamper tag
UHF4	communication with Base station	communication with exciters	communication with Base station	communication with Base station
WIFI	Includes	Includes	Includes	Does not include
UHF4 function description	start at Rx mode, when receiving transmission from Base station, then transmit at DC OF 50% Tx-----Rx	continuous transmission at DC of 50%: Tx---- Rx	start at Rx mode, when receiving transmission from Base station, then transmit at DC OF 50% Tx-----Rx	start at Rx mode, when receiving transmission from Base station, then transmit at DC OF 50% Tx-----Rx
SOM module	Includes	includes	includes	Does not include
Ethernet	Includes	Includes	Includes	Includes
RS485	Includes	Includes	Includes	Includes

We declare that the following products are identical, only difference is Lexan and cover shape:

Model name and p/n	Identical to model name and p/n
Base Station LTG2-01	Central Management Unit LTG2-01-PRF
Gate Locator LTG2-02	Door Management Unit LTG2-02-PRF
4 Channel Reader LTG2-03	Multi Location Unit LTG2-03-PRF
Gate Exciter GPRS LTG2-11	Door Management Unit GPRS LTG2-11-PRF

END OF DOCUMENT