HERMON LABORATORIES

ELECTRICAL TESTING
0839.01

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TEST REPORT

ACCORDING TO: FCC 47CFR part 15 subpart C § 15.247(DTS)

FOR:

Telematics Wireless Ltd.

Water meter booster

Model:Booster 2

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

Table of contents

1 Applicant information

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

2 Equipment under test attributes

Product name:	Water reader (Booster)
Product type:	Transceiver
Model(s):	Booster 2
Part number:	06535109
Receipt date	3/06/2011

3 Manufacturer information

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

4 Test details

Project ID:	21789
Location:	Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started:	3/06/2011
Test completed:	3/16/2011
Test specification(s):	FCC 47CFR part 15, subpart C, §15.247

5 Tests summary

Test	Status
Transmitter characteristics	
FCC section 15.247(b)3, RSS-210 section A8.4(4) ,Peak output power	Pass
FCC section 15.247(e), RSS-210 A8.2(b), Peak power density	Pass
FCC section 15.247(d), Radiated spurious emissions	Pass*

* The test was performed for FHSS mode which produced the maximum power. The test results are given in the test report TELRAD_FCC.21789_FHSS.

The integral ("external") antenna was changed in the cerified product FCC ID:NTAWB2. Only the relevant tests were performed for updated product. Full test results are provided in the test reports TELRAD_FCC.20425_DTS_rev1 and TELRAD_FCC.20425_FHSS_rev1.

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	March 16, 2011	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	March 31, 2011	
Approved by:	Mr. M. Nikishin, EMC and radio group manager	April 3, 2011	

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6 EUT description

6.1 General information

The EUT, water meter booster (WMB), is a transceiver operating in three transmit modes: 905.55-924.75 MHz range (FHSS and DTS, PSK modulation) and @916.3 MHz (DTS, FSK modulation) without simultaneous operation.
The WMB communicates by a RF channel (path No.2 is Tx with PSK modulation and path No.4 is Rx at 916.3 MHz) with up to 2 meters and collects their data. The collected data is transmitted by the WMB towards the concentrator by the RF channel path No.1 using a Frequency Hopping or Direct Sequence Spread Spectrum techniques. The EUT receives the programming parameters and commands from a programmer and transmits the response (path No.5 is Tx with FSK modulation and path No.3 is Rx at 916.3 MHz).

Figure 6.1.1 EUT operational modes block diagram

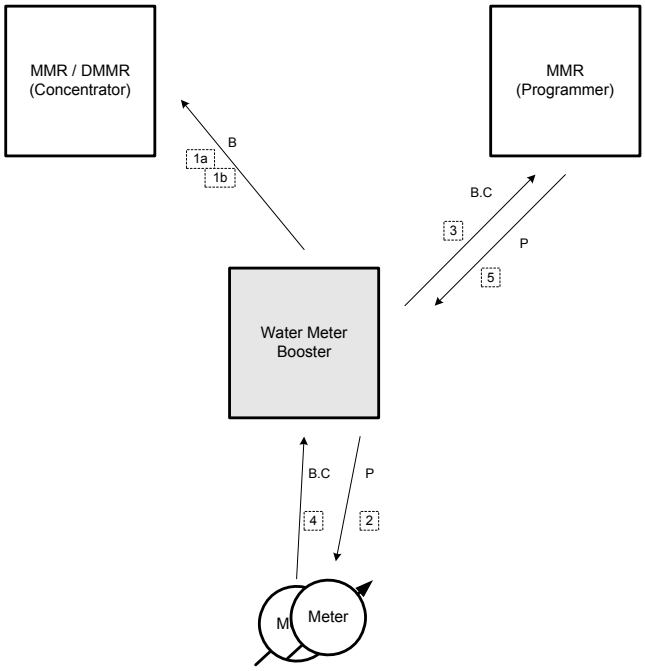


Table 6.1.1 EUT operational modes overview

Modulation technique	Low frequency	Mid frequency	High frequency	Power setting
Frequency-hopping spread spectrum (FHSS), External antenna	905. 55	915.00	924.75	85
Direct-Sequence Spread Spectrum (DSSS) FSK, External antenna	–	916.30	–	1E
Direct-Sequence Spread Spectrum (DSSS) FSK, Internal antenna	–	916.30	–	NA
Direct-Sequence Spread Spectrum (DSSS) PSK, External antenna	905.55	915.00	924.75	6A

6.2 Transmitter characteristics for operation in 905.55-924.75 MHz

Type of equipment	
	Stand-alone (Equipment with or without its own control provisions)
X	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)
	Plug-in card (Equipment intended for a variety of host systems)

Intended use		**Condition of use**
	fixed	Always at a distance more than 2 m from all people
X	mobile	Always at a distance more than 20 cm from all people
	portable	May operate at a distance closer than 20 cm to human body

Assigned frequency range	902-928 MHz
Operating frequency range	905.55-924.75 MHz
RF channel spacing	NA

Maximum rated output power	At transmitter 50 Ω RF output connector	NA
	Peak output power	16.51 dBm

Is transmitter output power variable?	X	No		
		Yes		continuous variable
				stepped variable with stepsize: dB
			minimum RF power	dBm
			maximum RF power	dBm

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

Antenna/s technical characteristics			
Type	Manufacturer	Model number	Gain
Integrated	Telematics Wireless	Printed OMNI antenna	3 dBi

Transmitter aggregate data rate/s	120 kbps				
Transmitter aggregate symbol (baud) rate/s	NA				
Type of modulation	PSK				
Modulating test signal (baseband)	PRBS				
Maximum transmitter duty cycle in normal use	0.1%				
Transmitter duty cycle supplied for test (DTS)	0.65%	**Tx ON time**	2.7 msec	**Period**	418.8 msec

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

Common power source for transmitter and receiver	X	yes	no

Spread spectrum technique used	X	Frequency hopping (FHSS)
	X	Digital transmission system (DTS)
		Hybrid

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

6.3 Transmitter characteristics for operation @916.3 MHz

Type of equipment	
	Stand-alone (Equipment with or without its own control provisions)
X	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)
	Plug-in card (Equipment intended for a variety of host systems)

Intended use		**Condition of use**
	fixed	Always at a distance more than 2 m from all people
X	mobile	Always at a distance more than 20 cm from all people
	portable	May operate at a distance closer than 20 cm to human body

Assigned frequency range	902-928 MHz
Operating frequency range	916.3 MHz
RF channel spacing	NA

Maximum rated output power	At transmitter 50 Ω RF output connector	NA
	Peak output power	7.17 dBm

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

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

Antenna/s technical characteristics			
Type	Manufacturer	Model number	Gain
Integrated	Telematics Wireless	Printed OMNI antenna	3 dBi
“Internal”	Telematics Wireless	Printed λ/4	3 dBi

Transmitter aggregate data rate/s	120 kbps				
Transmitter aggregate symbol (baud) rate/s	NA				
Type of modulation	FSK				
Modulating test signal (baseband)	PRBS				
Maximum transmitter duty cycle in normal use	0.1%				
Transmitter duty cycle supplied for test	1.22%	**Tx ON time**	5.12 msec	**Period**	418.8 msec

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

Common power source for transmitter and receiver	X	yes	no

Spread spectrum technique used		Frequency hopping (FHSS)
	X	Digital transmission system (DTS)
		Hybrid

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

Test specification:	FCC section 15.247(b)3, Peak output power		
Test procedure:	FR Vol.62, page 26243, Section 15.247(b)		
Test mode:	Compliance	Verdict:	PASS
Date:	3/14/2011 - 3/16/2011		
Temperature: 21 ºC	Air Pressure: 1024 hPa	Relative Humidity: 38 %	Power Supply: Battery
Remarks:			

7 Transmitter tests according to 47CFR part 15 subpart C §15.247 (DTS) requirements

7.1 Peak output power

7.1.1 General

This test was performed to measure the maximum peak output power radiated by transmitter. Specification test limits are given in Table 7.1.1.

Table 7.1.1 Peak output power limits

Assigned frequency range, MHz	Maximum antenna gain, dBi	Peak output power*		Equivalent field strength limit @ 3m, dB(μV/m)**
		W	dBm	
902.0 – 928.0	6.0	1.0	30.0	131.2
2400.0 – 2483.5				
5725.0 – 5850.0				

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

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

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

7.1.2 Test procedure

7.1.2.1 The EUT was set up as shown in Figure 7.1.1, energized and its proper operation was checked.

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

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

7.1.2.4 The maximum field strength of the EUT carrier frequency was measured as provided in Table 7.1.2 and associated plots.

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

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

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

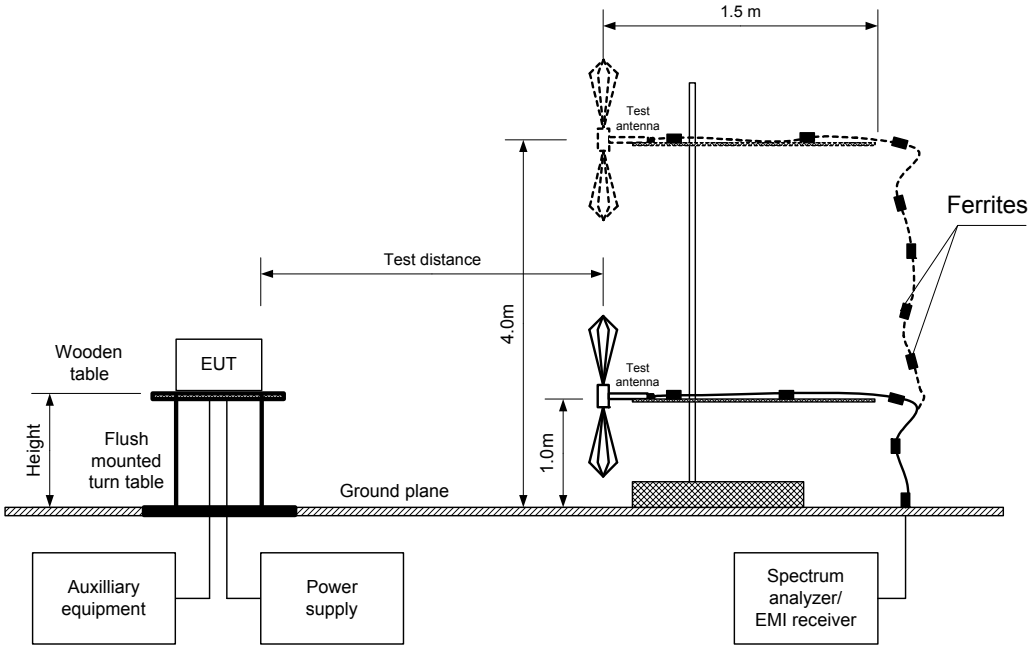
The above equation was converted in logarithmic units for 3 m test distance:

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

7.1.2.6 The worst test results (the lowest margins) were recorded in Table 7.1.2.

Test specification:	FCC section 15.247(b)3, Peak output power		
Test procedure:	FR Vol.62, page 26243, Section 15.247(b)		
Test mode:	Compliance	Verdict:	PASS
Date:	3/14/2011 - 3/16/2011		
Temperature: 21 ºC	Air Pressure: 1024 hPa	Relative Humidity: 38 %	Power Supply: Battery
Remarks:			

Figure 7.1.1 Setup for carrier field strength measurements



Test specification:	**FCC section 15.247(b)3, Peak output power**		
Test procedure:	FR Vol.62, page 26243, Section 15.247(b)		
Test mode:	Compliance	**Verdict:**	PASS
Date:	3/14/2011 - 3/16/2011		
Temperature: 21 ºC	**Air Pressure:** 1024 hPa	**Relative Humidity:** 38 %	**Power Supply:** Battery
Remarks:			

Table 7.1.2 Peak output power test results

ASSIGNED FREQUENCY RANGE: 902-928 MHz
TEST DISTANCE: 3 m
TEST SITE: Semi anechoic chamber
EUT HEIGHT: 0.8 m
DETECTOR USED: Peak
TEST ANTENNA TYPE: Biconilog (30 MHz – 1000 MHz)
Double ridged guide (above 1000 MHz)
MODULATING SIGNAL: PRBS
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
DETECTOR USED: Peak

MODULATION: PSK

Frequency, MHz	Field strength, dB(µV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	EUT antenna gain, dBi	Peak output power, dBm**	Limit, dBm	Margin, dB***	Verdict
905.425	114.71	Vertical	1	200	3	16.51	30	-13.49	Pass
914.988	113.75	Vertical	1	193	3	15.55	30	-14.45	Pass
924.738	112.21	Vertical	1.09	189	3	14.01	30	-15.99	Pass

MODULATION: FSK

Frequency, MHz	Field strength, dB(µV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	EUT antenna gain, dBi	Peak output power, dBm**	Limit, dBm	Margin, dB***	Verdict
916.425	105.37	Vertical	1.1	190	3	7.17	30	-22.83	Pass

*****- EUT front panel refer to 0 degrees position of turntable.
******- Peak output power was calculated from the field strength of carrier as follows: $P = (E \times d)^2 / (30 \times G)$,
where P is the peak output power in W, E is the field strength in V/m, d is the test distance in meters and G is the transmitter numeric antenna gain over an isotropic radiator. The above equation was converted in logarithmic units for 3 m test distance: *Peak output power in dBm = Field strength in dB(µV/m) - Transmitter antenna gain in dBi – 95.2 dB*
***- Margin = Peak output power – specification limit.
Note: Maximum peak output power was obtained at U_{nom} (115%U_{nom}, 85%U_{nom}) input power voltage.

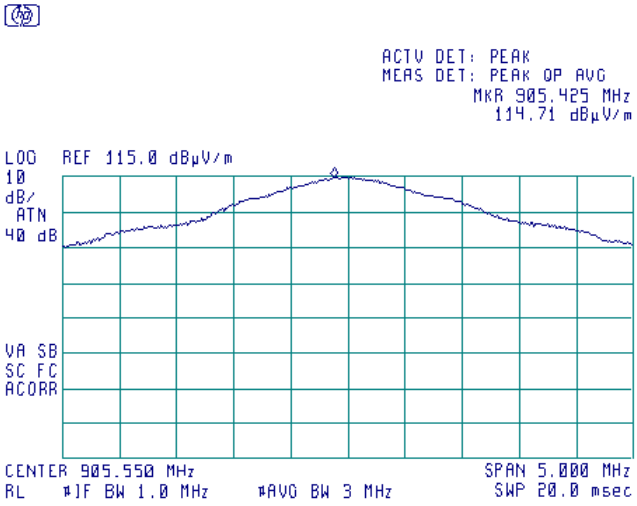
Reference numbers of test equipment used

HL 0521	HL 0604	HL 2871	HL 3623				

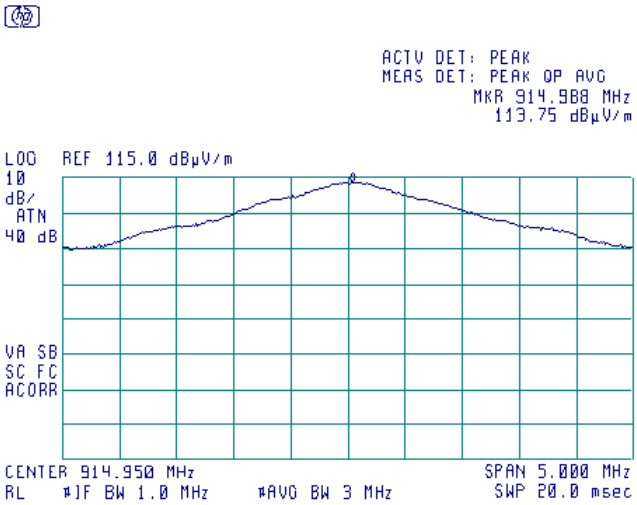
Full description is given in Appendix A.

Test specification:	FCC section 15.247(b)3, Peak output power		
Test procedure:	FR Vol.62, page 26243, Section 15.247(b)		
Test mode:	Compliance	Verdict:	PASS
Date:	3/14/2011 - 3/16/2011		
Temperature: 21 ºC	Air Pressure: 1024 hPa	Relative Humidity: 38 %	Power Supply: Battery
Remarks:			

Plot 7.1.1 Field strength of carrier at low frequency, PSK modulation

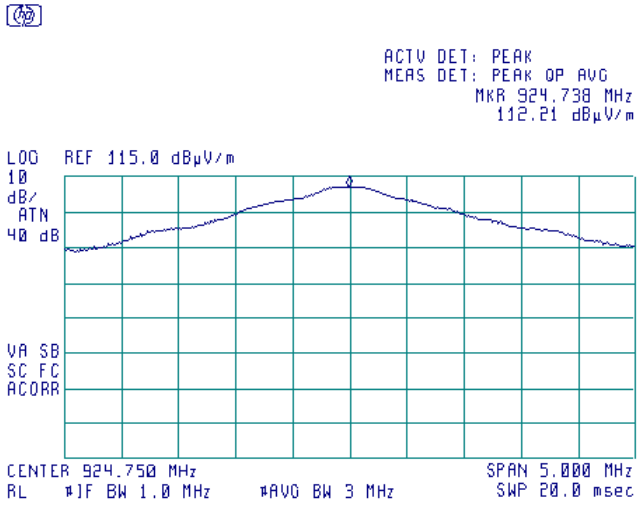


Plot 7.1.2 Field strength of carrier at mid frequency, PSK modulation

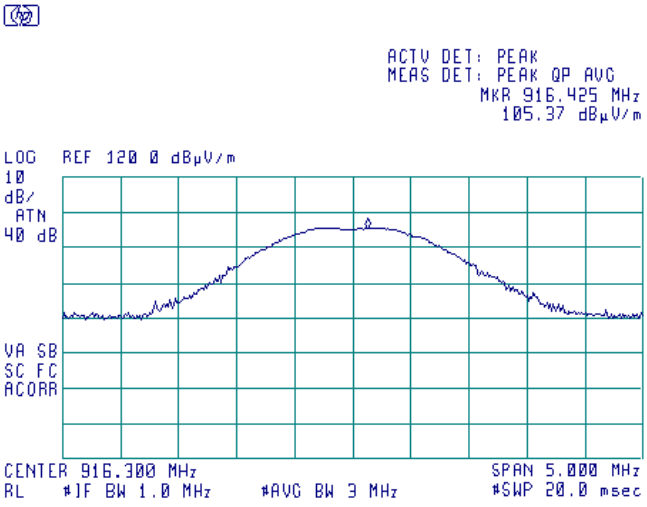


Test specification:	FCC section 15.247(b)3, Peak output power		
Test procedure:	FR Vol.62, page 26243, Section 15.247(b)		
Test mode:	Compliance	Verdict:	PASS
Date:	3/14/2011 - 3/16/2011		
Temperature: 21 ºC	Air Pressure: 1024 hPa	Relative Humidity: 38 %	Power Supply: Battery
Remarks:			

Plot 7.1.3 Field strength of carrier at high frequency, PSK modulation



Plot 7.1.4 Peak output power at FSK modulation



Test specification:	FCC section 15.247(e), Peak power density		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(d)		
Test mode:	Compliance	Verdict:	PASS
Date:	3/14/2011 - 3/16/2011		
Temperature: 21 ºC	Air Pressure: 1024 hPa	Relative Humidity: 38 %	Power Supply: Battery
Remarks:			

7.2 Peak spectral power density

7.2.1 General

This test was performed to measure the peak spectral power density radiated by the transmitter RF antenna. Specification test limits are given in Table 7.2.1.

Table 7.2.1 Peak spectral power density limits

Assigned frequency range, MHz	Measurement bandwidth, kHz	Peak spectral power density, dBm	Equivalent field strength limit @ 3m, dB(μV/m)*
902.0 – 928.0	3.0	8.0	103.2
2400.0 – 2483.5			
5725.0 – 5850.0			

* - Equivalent field strength limit was calculated from the peak spectral power density as follows: E=sqrt(30×P)/r, where P is peak spectral power density and r is antenna to EUT distance in meters.

7.2.2 Test procedure for field strength measurements

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

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

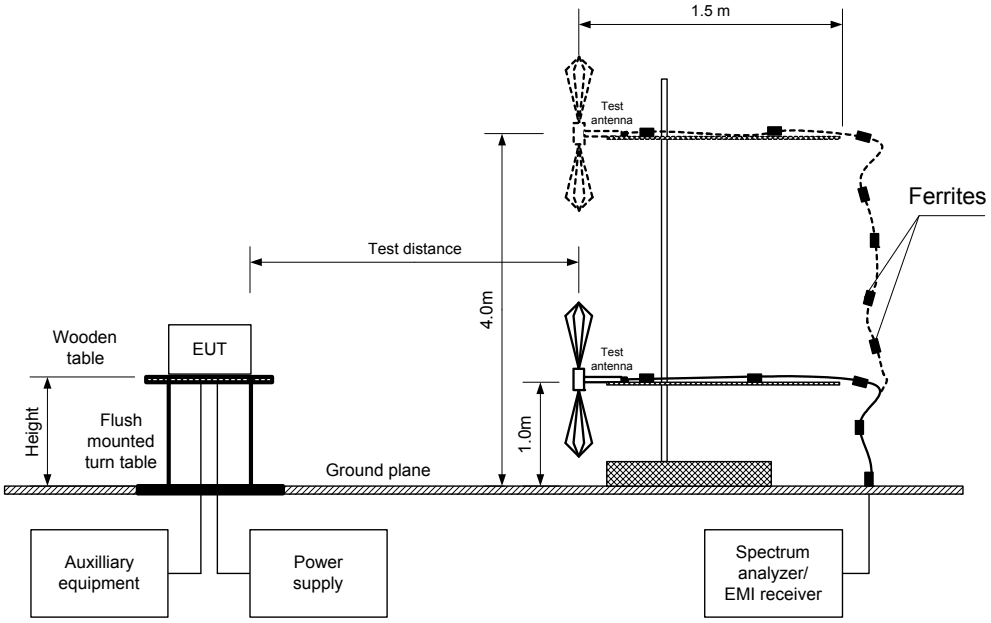
7.2.2.3 The field strength of the EUT carrier frequency was measured with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360^0 and the measuring antenna height was swept in both vertical and horizontal polarizations.

7.2.2.4 The frequency span of spectrum analyzer was set to capture the entire 6 dB band of the transmitter, in peak hold mode with resolution bandwidth set to 3.0 kHz, video bandwidth wider than resolution bandwidth, auto sweep time and sufficient number of sweeps was allowed for trace stabilization. The spectrum lines spacing was verified to be wider than 3 kHz. Otherwise the resolution bandwidth was reduced until individual spectrum lines were resolved and the power of individual spectrum lines was integrated over 3 kHz band.

7.2.2.5 The peak of emission was zoomed with span set just wide enough to capture the emission peak area and sweep time was set equal to span width divided by resolution bandwidth. Spectrum analyzer was set in peak hold mode, sufficient number of sweeps was allowed for trace stabilization and peak spectral power density was measured as provided in Table 7.2.2 and associated plots.

Test specification:	FCC section 15.247(e), Peak power density		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(d)		
Test mode:	Compliance	Verdict:	PASS
Date:	3/14/2011 - 3/16/2011		
Temperature: 21 ºC	Air Pressure: 1024 hPa	Relative Humidity: 38 %	Power Supply: Battery
Remarks:			

Figure 7.2.1 Setup for carrier field strength measurements



Test specification:	FCC section 15.247(e), Peak power density		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(d)		
Test mode:	Compliance	Verdict:	PASS
Date:	3/14/2011 - 3/16/2011		
Temperature: 21 ºC	Air Pressure: 1024 hPa	Relative Humidity: 38 %	Power Supply: Battery
Remarks:			

Table 7.2.2 Field strength measurement of peak spectral power density

ASSIGNED FREQUENCY:	902-928 MHz
TEST DISTANCE:	3 m
TEST SITE:	Semi anechoic chamber
EUT HEIGHT:	0.8 m
DETECTOR USED:	Peak
RESOLUTION BANDWIDTH:	3 kHz
VIDEO BANDWIDTH:	10 kHz
TEST ANTENNA TYPE:	Biconilog (30 MHz – 1000 MHz) Double ridged guide (above 1000 MHz)
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum

MODULATION: PSK

Frequency, MHz	Field strength, dB(μV/m)	EUT antenna gain, dBi	Limit, dB(μV/m)	Margin, dB*	Antenna polarization	Antenna height, m	Turn-table position**, degrees
906.1028	106.10	3	103.2	-0.10	Vertical	1	200
914.9943	101.26	3	103.2	-4.94	Vertical	1	193
924.1880	104.91	3	103.2	-1.29	Vertical	1	0

MODULATION: FSK

Frequency, MHz	Field strength, dB(μV/m)	EUT antenna gain, dBi	Limit, dB(μV/m)	Margin, dB*	Antenna polarization	Antenna height, m	Turn-table position**, degrees
916.12	101.56	3	103.2	-4.64	Vertical	1.1	190

*****- Margin = Field strength - EUT antenna gain - calculated field strength limit.
******- EUT front panel refer to 0 degrees position of turntable.

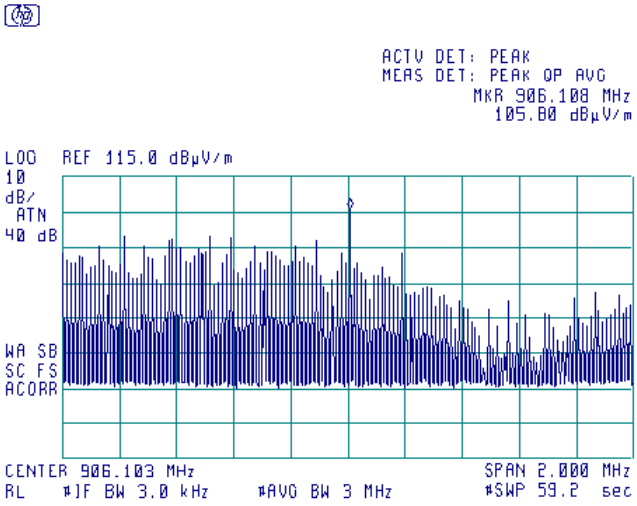
Reference numbers of test equipment used

HL 0521	HL 0604	HL 2871	HL 3623				

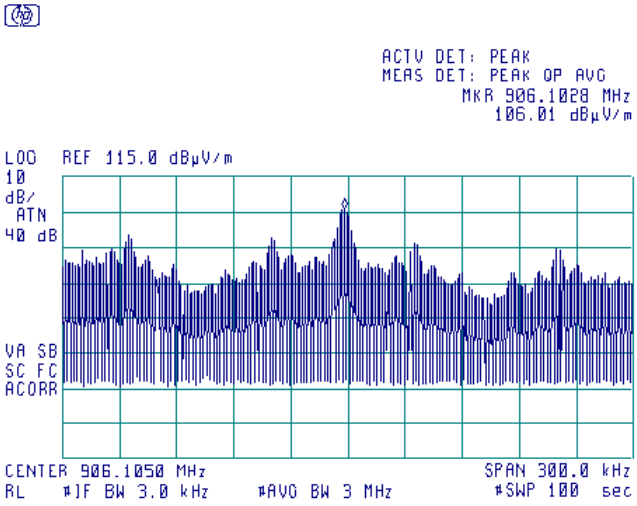
Full description is given in Appendix A.

Test specification:	FCC section 15.247(e), Peak power density		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(d)		
Test mode:	Compliance	Verdict:	PASS
Date:	3/14/2011 - 3/16/2011		
Temperature: 21 ºC	Air Pressure: 1024 hPa	Relative Humidity: 38 %	Power Supply: Battery
Remarks:			

Plot 7.2.1 Peak spectral power density at low frequency within 6 dB band, PSK modulation

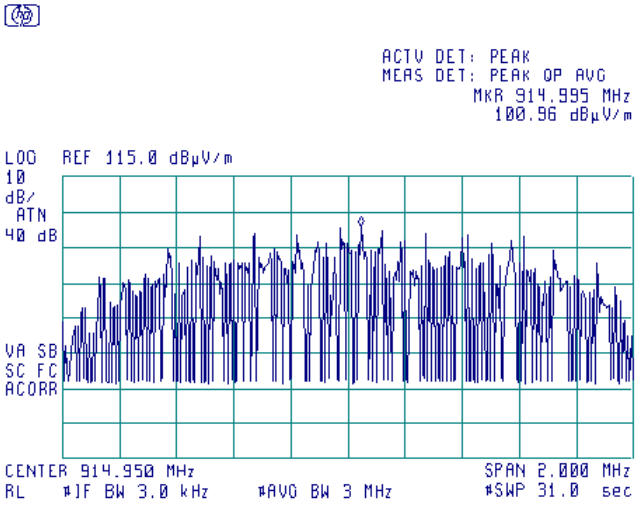


Plot 7.2.2 Peak spectral power density at low frequency zoomed at the peak, PSK modulation

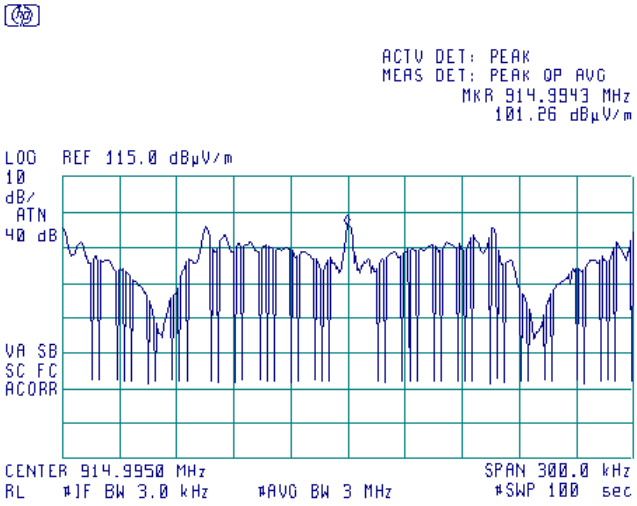


Test specification:	FCC section 15.247(e), Peak power density		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(d)		
Test mode:	Compliance	Verdict:	PASS
Date:	3/14/2011 - 3/16/2011		
Temperature: 21 ºC	Air Pressure: 1024 hPa	Relative Humidity: 38 %	Power Supply: Battery
Remarks:			

Plot 7.2.3 Peak spectral power density at mid frequency within 6 dB band, PSK modulation

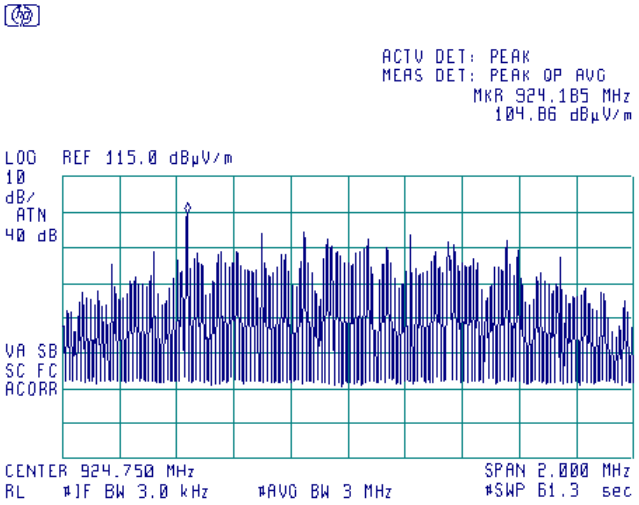


Plot 7.2.4 Peak spectral power density at mid frequency zoomed at the peak, PSK modulation

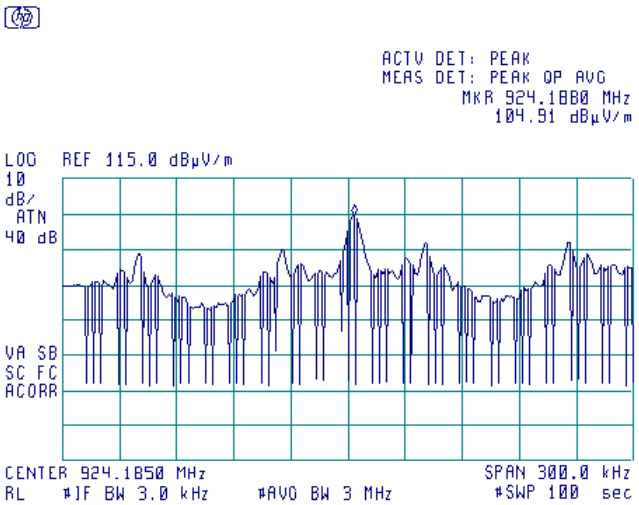


Test specification:	FCC section 15.247(e), Peak power density		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(d)		
Test mode:	Compliance	Verdict:	PASS
Date:	3/14/2011 - 3/16/2011		
Temperature: 21 ºC	Air Pressure: 1024 hPa	Relative Humidity: 38 %	Power Supply: Battery
Remarks:			

Plot 7.2.5 Peak spectral power density at high frequency within 6 dB band, PSK modulation

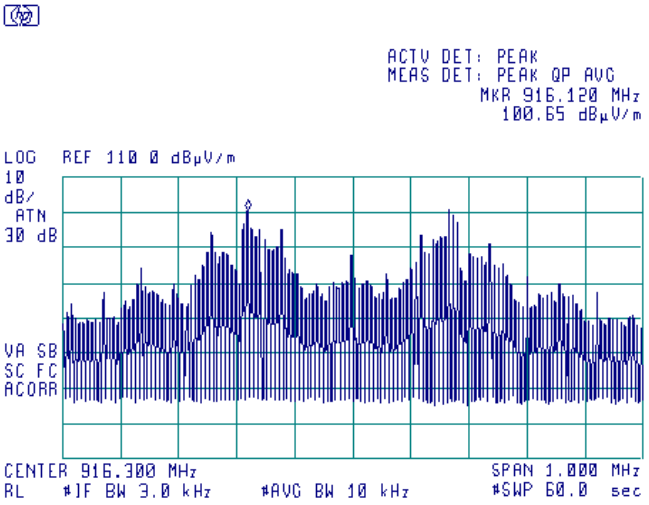


Plot 7.2.6 Peak spectral power density at high frequency zoomed at the peak, PSK modulation

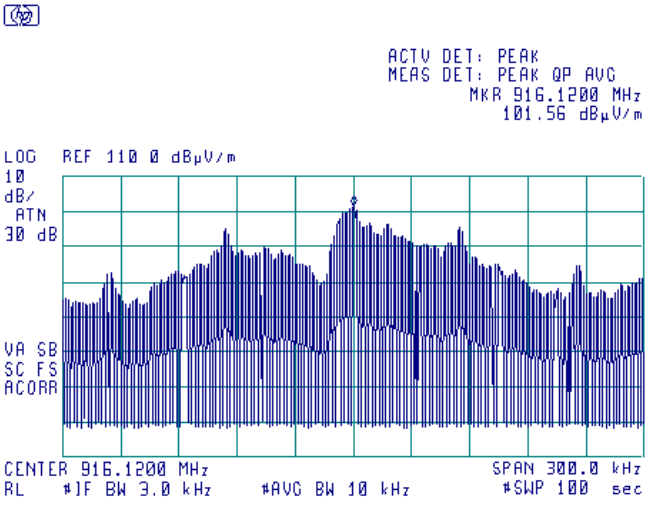


Test specification:	FCC section 15.247(e), Peak power density		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(d)		
Test mode:	Compliance	Verdict:	PASS
Date:	3/14/2011 - 3/16/2011		
Temperature: 21 ºC	Air Pressure: 1024 hPa	Relative Humidity: 38 %	Power Supply: Battery
Remarks:			

Plot 7.2.7 Peak spectral power density within 6 dB band, FSK modulation



Plot 7.2.8 Peak spectral power density zoomed at the peak, FSK modulation



8 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	25-Aug-10	25-Aug-11
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	11-Jan-11	11-Jan-12
2871	Microwave Cable Assembly, 18 GHz, 6.4 m, SMA - SMA	Huber-Suhner	198-8155-00	2871	14-Sep-10	14-Sep-11
3623	Cable RF, 6.0 m, N type-N type, DC-6.5 GHz	Belden	MIL C-17	NA	27-May-10	27-May-11

9 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Conducted carrier power at RF antenna connector	Below 12.4 GHz: ± 1.7 dB 12.4 GHz to 40 GHz: ± 2.3 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
Occupied bandwidth	± 8.0 %
Duty cycle, timing (Tx ON / OFF) and average factor measurements	± 1.0 %
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

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.

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11 APPENDIX D Specification references

FCC 47CFR part 15: 2010	Radio Frequency Devices.
FR Vol.62	Federal Register, Volume 62, May 13, 1997
FCC New Guidance:2004	FCC New Guidance on Measurements for DTS
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.

12 APPENDIX E Test equipment correction factors

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 intensity in dB(μV/m).

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
Cable coaxial, MIL C-17, N type-N type, 6 m
Belden, HL 3623

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.13	2600	4.38	5400	7.76
30	0.25	2700	4.53	5500	7.79
50	0.33	2800	4.64	5600	7.88
100	0.49	2900	4.79	5700	7.93
200	0.76	3000	4.93	5800	8.05
300	0.97	3100	5.02	5900	8.03
400	1.18	3200	5.18	6000	8.07
500	1.38	3300	5.27	6100	8.14
600	1.54	3400	5.41	6200	8.21
700	1.71	3500	5.57	6300	8.28
800	1.88	3600	5.65	6400	8.35
900	2.04	3700	5.82	6500	8.43
1000	2.19	3800	5.89		
1100	2.38	3900	6.02		
1200	2.61	4000	6.15		
1300	2.63	4100	6.26		
1400	2.79	4200	6.37		
1500	2.90	4300	6.52		
1600	3.08	4400	6.63		
1700	3.21	4500	6.74		
1800	3.31	4600	6.86		
1900	3.47	4700	6.98		
2000	3.59	4800	7.09		
2100	3.74	4900	7.17		
2200	3.86	5000	7.30		
2300	3.98	5100	7.41		
2400	4.12	5200	7.59		
2500	4.24	5300	7.71		

13 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
A/m	ampere per meter
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

END OF DOCUMENT