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839.01
Electrical

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TEST REPORT

ACCORDING TO: FCC 47CFR part 27

FOR:

Arcadian Networks Inc.

Wireless Modem

Model:AE11GOW

Table of contents

1 Applicant information

Client name:	Arcadian Networks Inc
Address:	400 Columbus Avenue, Suite 210E, Valhalla NY 10595, USA
Telephone:	+972 3976 9847
Fax:	+972 3976 9998
E-mail:	hillel.hendler@arcadiannetworks.com
Contact name:	Mr. Hillel Hendler

2 Equipment under test attributes

Product name:	Wireless modem
Model(s):	AE11GOW
Serial number:	H0090001
Hardware version:	01
Software release:	01
Receipt date	3/9/2010

3 Manufacturer information

Manufacturer name:	Arcadian Networks Inc
Address:	400 Columbus Avenue, Suite 210E, Valhalla NY 10595, USA
Telephone:	+972 3976 9847
Fax:	+972 3976 9998
E-Mail:	hillel.hendler@arcadiannetworks.com
Contact name:	Mr. Hillel Hendler

4 Test details

Project ID:	20571
Location:	Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started:	3/9/2010
Test completed:	3/18/2010
Test specification(s):	FCC 47CFR part 27

5 Tests summary

Test	Status
Transmitter characteristics	
Section 27.50(b)(9), Peak output power at RF antenna connector	Pass
Section 2.1091, 27.52, RF safety	Pass
Section 27.53(c)(2), Spurious emissions RF antenna connector	Pass
Section 27.53(c)(3), Spurious emissions RF antenna connector in 763-775 MHz and 793-805 MHz	Pass
Section 27.53(c)(2), Radiated spurious emissions	Pass
Section 27.53(f), Radiated spurious emissions in 1559-1610 MHz band	Pass
Section 27.54, Frequency stability	Pass
Section 2.1049, 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:	Mr. L. Markel, test engineer	March 18, 2010	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	March 23, 2010	
Approved by:	Mr. M. Nikishin, EMC and Radio group manager	March 24, 2010	

6 EUT description

6.1 General information

The EUT, AE11GOW wireless modem, includes one V487 module Tx/Rx (787.0-788.0/757.0-758.0 MHz), one 902-928 frequency hopping module and one licensed modem 890-902 & 928-960 MHz approved as a modular transmitter.

6.2 Ports and lines

Port type	Port description	Conn. from	Connected to	Qty.	Cable type	Cable length, m	Indoor / outdoor
Power	DC power	Power supply	EUT	1	Unshielded	1.5	Outdoor
RF 787-788 MHz	Antenna	EUT	Termination/Antenna	1	Coax	NA	Outdoor
Signal	Ethernet	PC	EUT	1	Shielded	15	Outdoor
Signal	RS-232	EUT	Not connected	1	NA	NA	For maintance only
RF 902-928 MHz	Antenna	EUT	Antenna	1	Coax	1	Outdoor
RF 900 MHz	Antenna	EUT	Termination	1	Coax	NA	Outdoor

6.3 Support and test equipment

Description	Manufacturer	Model number	Serial number
PC	NA	NA	TZ02060330596

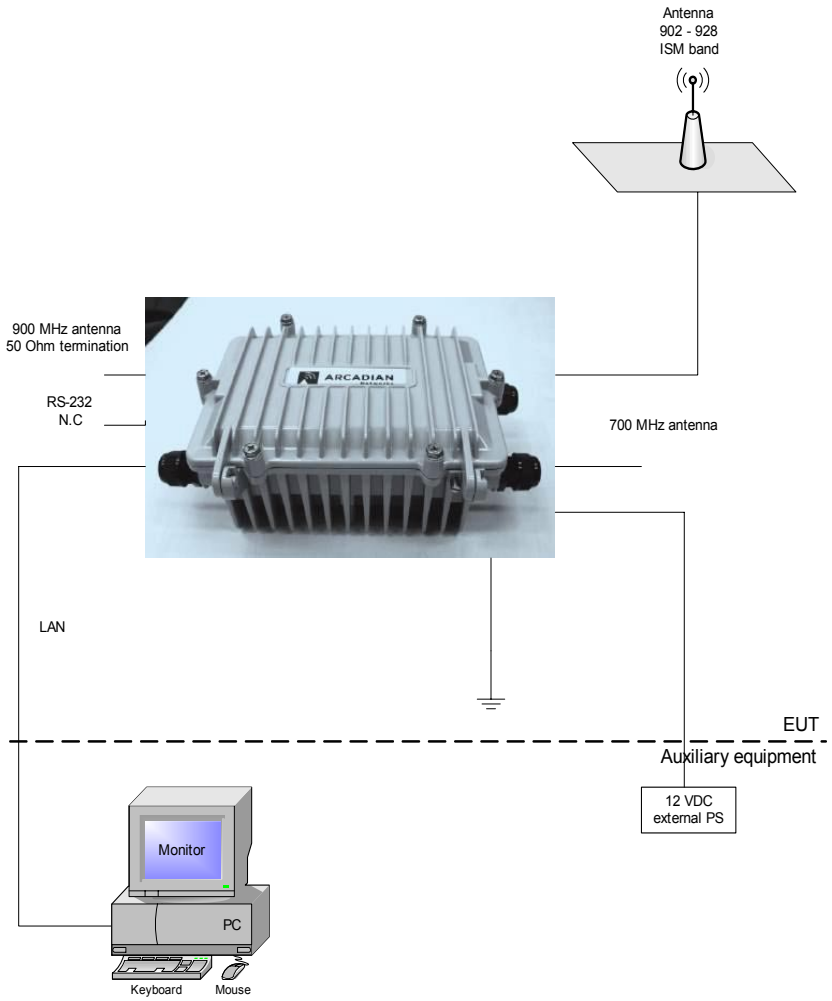
6.4 Operating frequencies

Source	Frequency, MHz
Tx	787.0 - 788.0
Rx	757.0 - 758.0
Tx/Rx	902.0 - 928.0
First LO	1302.0 - 1328.0
Clock	26, 24, 13 (TXCO), 16(XTAL)
LO	743.5

6.5 Changes made in the EUT

No changes were implemented.

6.6 Test configuration



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6.7 Transmitter characteristics

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

Intended use		Condition of use
X	fixed	Always at a distance more than 2 m from all people
	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	787.0 – 788.0 MHz
Receive frequency range	757.0 – 758.0 MHz
Transmit frequency range	787.125 – 787.875 MHz for 250 kHz channel bandwidth 787.170 – 787.830 MHz for 330 kHz channel bandwidth

Maximum rated output power	At transmitter 50 Ω RF output connector	29 dBm
	Effective radiated power (for equipment with no RF connector)	NA

Is transmitter output power variable?		No		
	X	Yes		continuous variable
			X	Stepped variable with stepsize: 0.25 dB
				minimum RF power: -17 dBm
				maximum RF power: 29 dBm

Antenna connection				
unique coupling	**X**	standard N-type connector	integral	with temporary RF connector
				without temporary RF connector

Antenna/s technical characteristics			
Type	Manufacturer	Model number	Gain
Yagi	A&D assembley	PAN690M012PF	14 dBi

Transmitter 99% power bandwidth	Bit rate, kBps	Symbol rate, kSym/s	Type of modulation (OFDM)
250 kHz	400	200	QPSK
	800	200	16QAM
330 kHz	520	260	QPSK
	1040	260	16QAM

Type of multiplexing	TDMA
Modulating test signal (baseband)	PRBS
Maximum transmitter duty cycle supplied for test	100%

RF channel spacing	Frequency channel		
	Low	**Mid**	**High**
250 kHz	787.125	787.375	787.875
330 kHz	787.170	787.500	787.830

Transmitter power source						
	Battery	**Nominal rated voltage**	VDC	Battery type		
X	DC	**Nominal rated voltage**	12 VDC from mains via power supply			
	AC mains	**Nominal rated voltage**	120 VAC	Frequency	60 Hz	

Common power source for transmitter and receiver	**X**	yes	no

Test specification:	Section 27.50(b)(9), Peak output power at RF antenna connector		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/09/2010 11:57:30 AM		
Temperature: 23.8 ºC	Air Pressure: 1009 hPa	Relative Humidity: 47 %	Power Supply: 12 VDC
Remarks:			

7 Transmitter tests according to 47CFR part 27

7.1 Peak output power test

7.1.1 General

This test was performed to measure the peak output power at RF antenna connector. Specification test limits are given in Table 7.1.1.

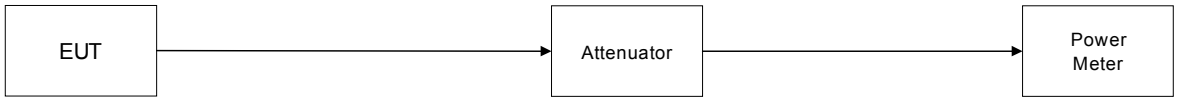
Table 7.1.1 Peak output power limits

Assigned frequency range, MHz	Maximum peak output power, ERP	
	W	dBm
787.0 – 788.0	30.0	44.77

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 the end user RF output power.
7.1.2.3 The peak output power was measured with power meter as provided in Table 7.1.2 and the associated plots.

Figure 7.1.1 Peak output power test setup



Test specification:	**Section 27.50(b)(9), Peak output power at RF antenna connector**		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/09/2010 11:57:30 AM		
Temperature: 23.8 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 47 %	**Power Supply:** 12 VDC
Remarks:			

Table 7.1.2 Peak output power test results

OPERATING FREQUENCY RANGE: 787.0 – 788.0 MHz
DETECTOR USED: Peak / Average (RMS)
RESOLUTION BANDWIDTH: NA
VIDEO BANDWIDTH: NA
MODULATING SIGNAL: PRBS
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
ANTENNA GAIN: 14 dBi = 11.85 dBd

Carrier frequency, MHz	Channel bandwidth, kHz	Power meter reading, Peak, dBm	Power meter reading, Average, dBm	RF output power, Average ERP*, Bm	Limit ERP, dBm	Margin, dB	Verdict
QPSK, 400 kbps							
787.375	250	33.68	29.05	40.90	44.77	-3.87	Pass
16QAM, 800 kbps							
787.375	250	34.16	28.56	40.41	44.77	-4.36	Pass
QPSK, 520 kbps							
787.500	330	33.59	28.87	40.72	44.77	-4.05	Pass
16QAM, 1040 kbps							
787.500	330	34.20	28.42	40.27	44.77	-4.50	Pass

* - RF output power ERP, dBm = Power meter reading average, dBm + Antenna gain, dBd
** - Margin, dB = Limit ERP, dBm - RF output power ERP*, dBm

NOTE: The 902-928 MHz modem enabled at mid frequency.

Reference numbers of test equipment used

HL 3301	HL 3302	HL 3442	HL 3762				

Full description is given in Appendix A.

Test specification:	Section 2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/09/2010 11:58:24 AM		
Temperature: 23.3 ºC	Air Pressure: 1009 hPa	Relative Humidity: 47 %	Power Supply: 12 VDC
Remarks:			

7.2 Occupied bandwidth test

7.2.1 General

This test was performed to measure transmitter occupied bandwidth. Specification test limits are given in Table 7.2.1.

Table 7.2.1 Occupied bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, dBc
787.0 – 788.0	26

* - Modulation envelope reference points are provided in terms of attenuation below the total average power.

7.2.2 Test procedure

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

7.2.2.2 The EUT was set to transmit the normally modulated carrier.

7.2.2.3 The transmitter occupied bandwidth was measured with spectrum analyzer as a frequency delta between the reference points on modulation envelope, the test results provided in Table 7.2.2 and the associated plots.

Figure 7.2.1 Occupied bandwidth test setup

Test specification:	**Section 2.1049, Occupied bandwidth**		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/09/2010 11:58:24 AM		
Temperature: 23.3 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 47 %	**Power Supply:** 12 VDC
Remarks:			

Table 7.2.2 Occupied bandwidth test results

DETECTOR USED: Peak
RESOLUTION BANDWIDTH: 0.5 – 2 % of OBW
VIDEO BANDWIDTH: 10 times RBW
MODULATION ENVELOPE REFERENCE POINTS: 26 dBc
MODULATING SIGNAL: PRBS

Carrier frequency, MHz	Occupied bandwidth, kHz	Limit, kHz	Margin, kHz	Verdict
250 kHz Channel spacing, QPSK, 400 kbps				
787.375	215.3	NA	NA	Pass
250 kHz Channel spacing, 16QAM, 800 kbps				
787.375	215.7	NA	NA	Pass
330 kHz Channel spacing, QPSK, 520 kbps				
787.500	280.0	NA	NA	Pass
330 kHz Channel spacing, 16QAM, 1040 kbps				
787.500	278.6	NA	NA	Pass

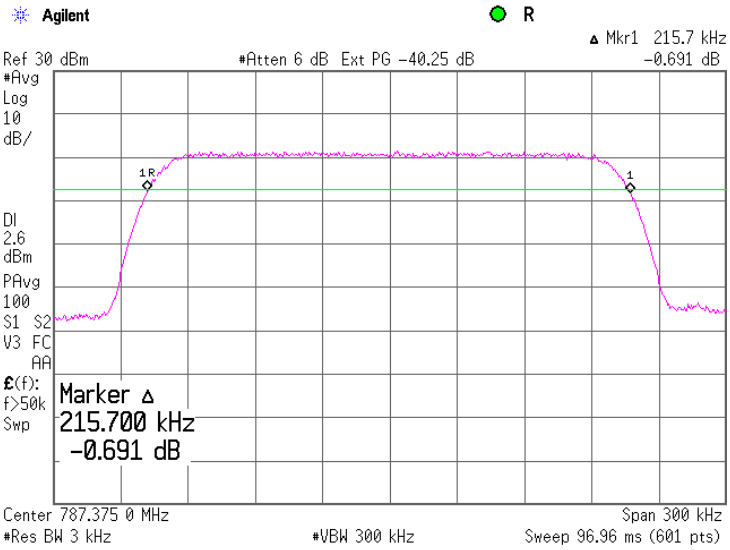
Reference numbers of test equipment used

HL 2951	HL 3442	HL 3762	HL 3818				

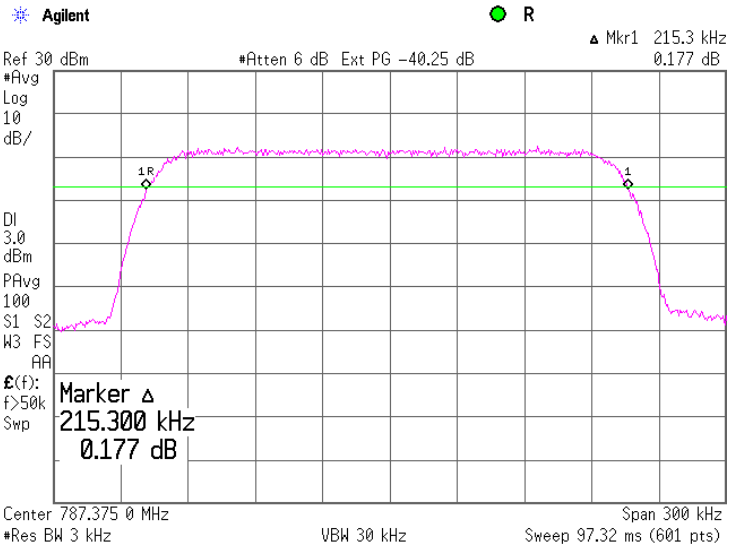
Full description is given in Appendix A.

Test specification:	Section 2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/09/2010 11:58:24 AM		
Temperature: 23.3 ºC	Air Pressure: 1009 hPa	Relative Humidity: 47 %	Power Supply: 12 VDC
Remarks:			

Plot 7.2.1 Occupied bandwidth test result at mid frequency 250 kHz CBW, 16QAM

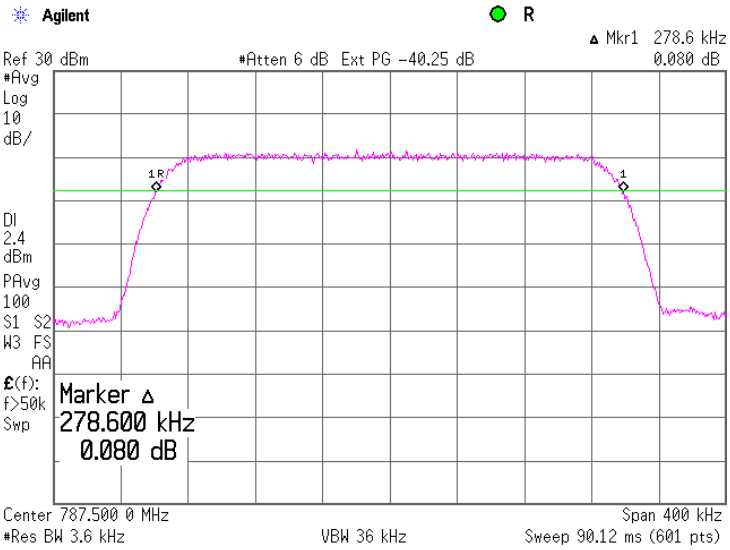


Plot 7.2.2 Occupied bandwidth test result at mid frequency 250 kHz CBW, QPSK

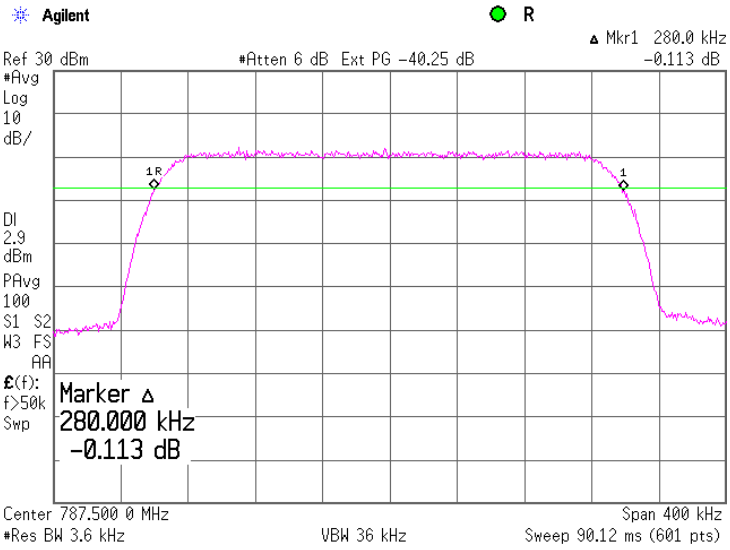


Test specification:	Section 2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/09/2010 11:58:24 AM		
Temperature: 23.3 ºC	Air Pressure: 1009 hPa	Relative Humidity: 47 %	Power Supply: 12 VDC
Remarks:			

Plot 7.2.3 Occupied bandwidth test result at mid frequency 330 kHz CBW, 16QAM



Plot 7.2.4 Occupied bandwidth test result at mid frequency 330 kHz CBW, QPSK



Test specification:	Section 27.53(c)(2), Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/09/2010 12:01:19 PM		
Temperature: 23.3 ºC	Air Pressure: 1009 hPa	Relative Humidity: 47 %	Power Supply: 12 VDC
Remarks: Band edges at 786-787 & 788-789 MHz bands			

7.3 Band edge emissions at RF antenna connector test

7.3.1 General

This test was performed to measure band edge emissions at RF antenna connector. Specification test limits are given in Table 7.3.1 and Table 7.3.2 .

Table 7.3.1 Spurious emission limits for 250 kHz CBW

Investigated frequency range, MHz	Attenuation below carrier, dBc	Spurious emissions, dBm	Measurement technique
786.9 - 787.0 788.0 - 788.1	43+10logP*	-13	RBW=30kHz; VBW=100 kHz; Average detector + Power average 100 sweeps
786.0 – 786.9 788.1 – 789.0	43+10logP*	-13	RBW=100 kHz; VBW=300kHz; Average detector + Power average 100 sweeps

NOTE1: In case of QPSK and 16QAM at low channel the RBW was reduced to 3 kHz and correction factor of 10log(30/3) = 10 dB was added to the measured value.

Table 7.3.2 Spurious emission limits for 330 kHz CBW

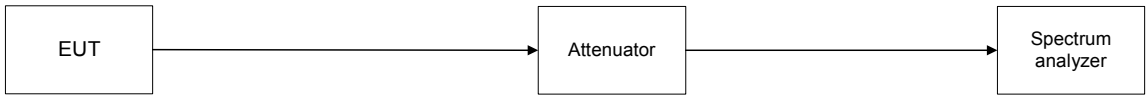
Investigated frequency range, MHz	Attenuation below carrier, dBc	Spurious emissions, dBm	Measurement technique
786.9 - 787.0 788.0 - 788.1	43+10logP*	-13	RBW=30kHz; VBW=100 kHz; Average detector + Power average 100 sweeps
786.0 – 786.9 788.1 – 789.0	43+10logP*	-13	RBW=100 kHz; VBW=300kHz; Average detector + Power average 100 sweeps

* - P is transmitter output power in Watts.

7.3.2 Test procedure

7.3.2.1 The EUT was set up as shown in Figure 7.3.1, energized and its proper operation was checked.
7.3.2.2 The EUT was adjusted to produce maximum available for end user RF output power.
7.3.2.3 The spurious emission was measured with spectrum analyzer as provided in the associated plots.

Figure 7.3.1 Spurious emission test setup



Test specification:	**Section 27.53(c)(2), Spurious emissions at RF antenna connector**		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/09/2010 12:01:19 PM		
Temperature: 23.3 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 47 %	**Power Supply:** 12 VDC
Remarks: Band edges at 786-787 & 788-789 MHz bands			

Table 7.3.3 Band edges emission test results

ASSIGNED FREQUENCY RANGE: 787.00 – 788.00 MHz
INVESTIGATED FREQUENCY RANGE: See Table 7.3.1 and Table 7.3.2
DETECTOR USED: Average
VIDEO BANDWIDTH: ≥ Resolution bandwidth
MODULATING SIGNAL: PRBS
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
CHANNEL SPACING: 250 kHz

Investigated Frequency range, MHz	SA reading, dBm	Required RBW, kHz	Used RBW, kHz	Correction factor*, dB	Spurious emission**, dBm	Limit, dBm	Margin, dB***	Verdict
787.125 MHz – Low channel								
QPSK								
786.9 – 787.0	-24.78	30	3	10.0	-14.78	-13.00	-1.78	Pass
786.0 – 786.9	-19.90	100	30	5.23	-14.67	-13.00	-1.67	Pass
787.875 MHz – High channel								
QPSK								
788.0 – 788.1	-25.88	30	3	10.0	-15.88	-13.00	-2.88	Pass
788.1 – 789.0	-20.96	100	30	5.23	-15.73	-13.00	-2.73	Pass
787.125 MHz – Low channel								
16QAM								
786.9 – 787.0	-23.31	30	3	10.0	-13.31	-13.00	-0.31	Pass
786.0 – 786.9	-19.10	100	30	5.23	-13.87	-13.00	-0.87	Pass
787.875 MHz – High channel								
16QAM								
788.0 – 788.1	-24.23	30	3	10.0	-14.23	-13.00	-1.23	Pass
788.1 – 789.0	-19.61	100	30	5.23	-14.38	-13.00	-1.38	Pass

CHANNEL SPACING: 330 kHz

Frequency, MHz	SA reading, dBm	Required RBW, kHz	Used RBW, kHz	Correction factor*, dB	Spurious emission**, dBm	Limit, dBm	Margin, dB***	Verdict
787.170 MHz – Low channel								
QPSK								
786.9 – 787.0	-27.40	30	3	10.0	-17.40	-13.00	-4.40	Pass
786.0 – 786.9	-21.75	100	30	5.23	-16.52	-13.00	-3.52	Pass
787.830 MHz – High channel								
QPSK								
788.0 – 788.1	-27.29	30	3	10.0	-17.29	-13.00	-4.29	Pass
788.1 – 789.0	-21.17	100	30	5.23	-15.94	-13.00	-2.94	Pass
787.170 MHz – Low channel								
16QAM								
786.9 – 787.0	-26.13	30	3	10.0	-16.13	-13.00	-3.13	Pass
786.0 – 786.9	-19.81	100	30	5.23	-14.58	-13.00	-1.58	Pass
787.830 MHz – High channel								
16QAM								
788.0 – 788.1	-25.35	30	10	10.0	-15.35	-13.00	-2.35	Pass
788.1 – 789.0	-19.53	100	30	5.23	-14.30	-13.00	-1.30	Pass

* - Correction factor, dB = 10 log (Required RBW, kHz / Used RBW, kHz)
** - Spurious emission, dBm = SA reading, dBm + Correction factor, dB.
*- Margin = Spurious emission – specification limit.

Reference numbers of test equipment used

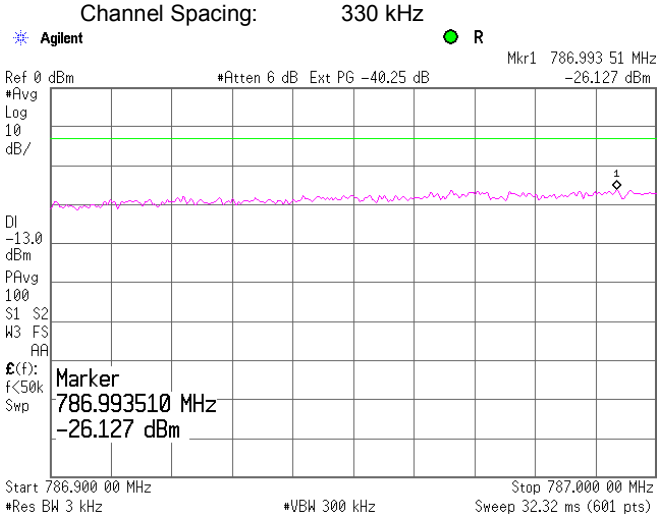
HL 2951	HL 3442	HL 3762	HL 3818				

Full description is given in Appendix A.

Test specification:	Section 27.53(c)(2), Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/09/2010 12:01:19 PM		
Temperature: 23.3 ºC	Air Pressure: 1009 hPa	Relative Humidity: 47 %	Power Supply: 12 VDC
Remarks: Band edges at 786-787 & 788-789 MHz bands			

Plot 7.3.1 Spurious emissions at RF antenna connector, low channel band edge measurements

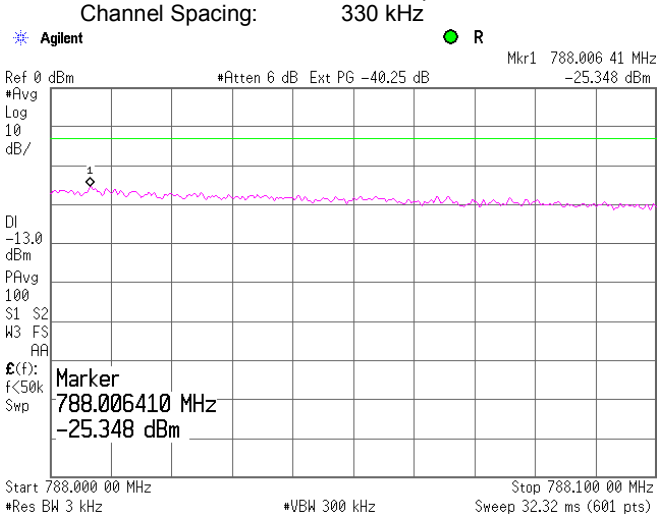
Frequency:	787.17 MHz
Band edge:	786.9 – 787.0 MHz
Modulation:	16QAM
Bit rate:	1040 kbps
Channel Spacing:	330 kHz



Correction factor = 10log(30/3) = 10 dB

Plot 7.3.2 Spurious emissions at RF antenna connector, high channel band edge measurements

Frequency:	787.83 MHz
Band edge:	788.0 – 788.1 MHz
Modulation:	16QAM
Bit rate:	1040 kbps
Channel Spacing:	330 kHz

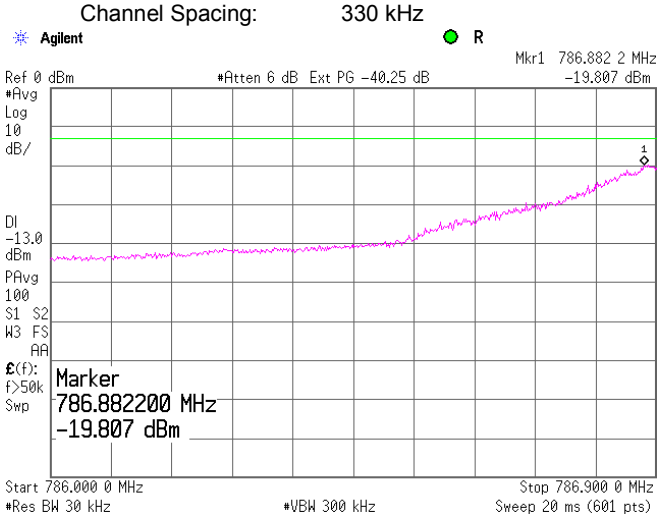


Correction factor = 10log(30/3) = 10 dB

Test specification:	Section 27.53(c)(2), Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/09/2010 12:01:19 PM		
Temperature: 23.3 ºC	Air Pressure: 1009 hPa	Relative Humidity: 47 %	Power Supply: 12 VDC
Remarks: Band edges at 786-787 & 788-789 MHz bands			

Plot 7.3.3 Spurious emissions at RF antenna connector, low channel band edge measurements

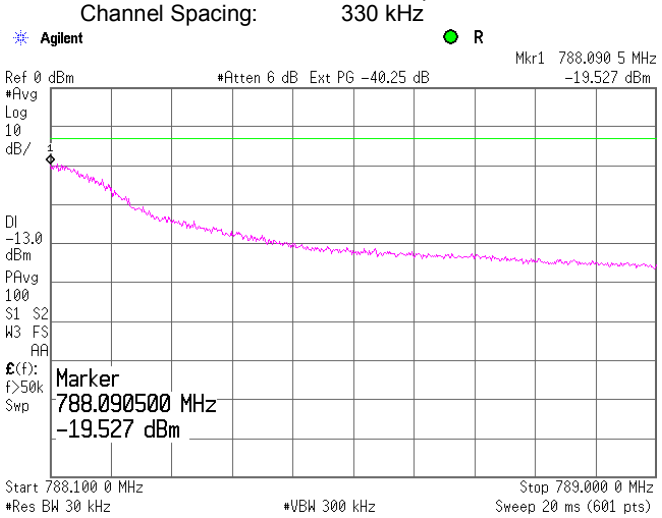
Frequency:	787.17 MHz
Band edge:	786.0 – 786.9 MHz
Modulation:	16QAM
Bit rate:	1040 kbps
Channel Spacing:	330 kHz



Correction factor = 10log(100/30) = 5.23 dB

Plot 7.3.4 Spurious emissions at RF antenna connector, high channel band edge measurements

Frequency:	787.83 MHz
Band edge:	788.1 – 789.0 MHz
Modulation:	16QAM
Bit rate:	1040 kbps
Channel Spacing:	330 kHz

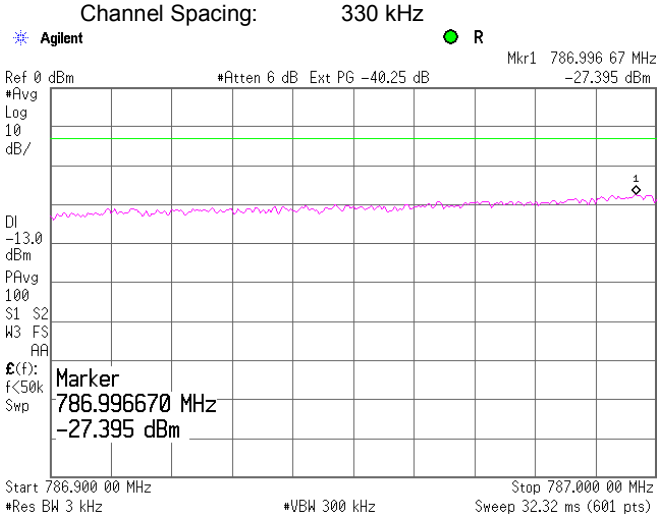


Correction factor = 10log(100/30) = 5.23 dB

Test specification:	Section 27.53(c)(2), Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/09/2010 12:01:19 PM		
Temperature: 23.3 ºC	Air Pressure: 1009 hPa	Relative Humidity: 47 %	Power Supply: 12 VDC
Remarks: Band edges at 786-787 & 788-789 MHz bands			

Plot 7.3.5 Spurious emissions at RF antenna connector, low channel band edge measurements

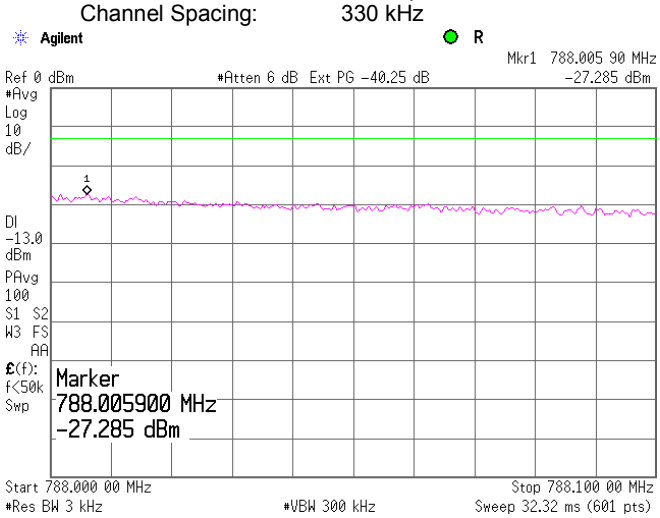
Frequency:	787.17 MHz
Band edge:	786.9 – 787.0 MHz
Modulation:	QPSK
Bit rate:	520 kbps
Channel Spacing:	330 kHz



Correction factor = 10log(30/3) = 10 dB

Plot 7.3.6 Spurious emissions at RF antenna connector, high channel band edge measurements

Frequency:	787.83 MHz
Band edge:	788.0 – 788.1 MHz
Modulation:	QPSK
Bit rate:	520 kbps
Channel Spacing:	330 kHz

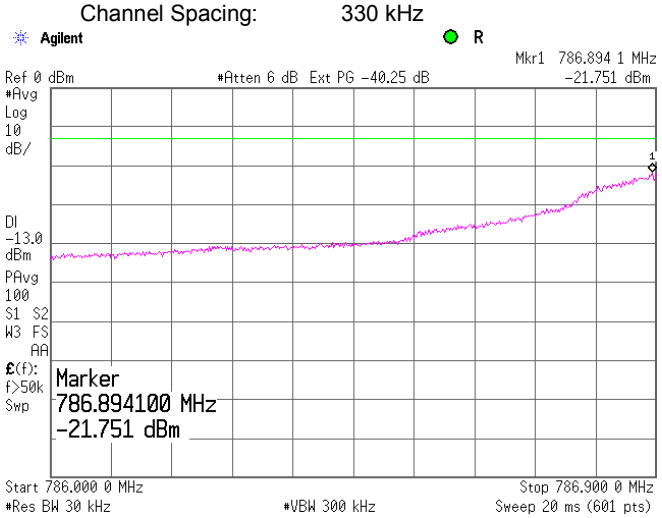


Correction factor = 10log(30/3) = 10 dB

Test specification:	Section 27.53(c)(2), Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/09/2010 12:01:19 PM		
Temperature: 23.3 ºC	Air Pressure: 1009 hPa	Relative Humidity: 47 %	Power Supply: 12 VDC
Remarks: Band edges at 786-787 & 788-789 MHz bands			

Plot 7.3.7 Spurious emissions at RF antenna connector, low channel band edge measurements

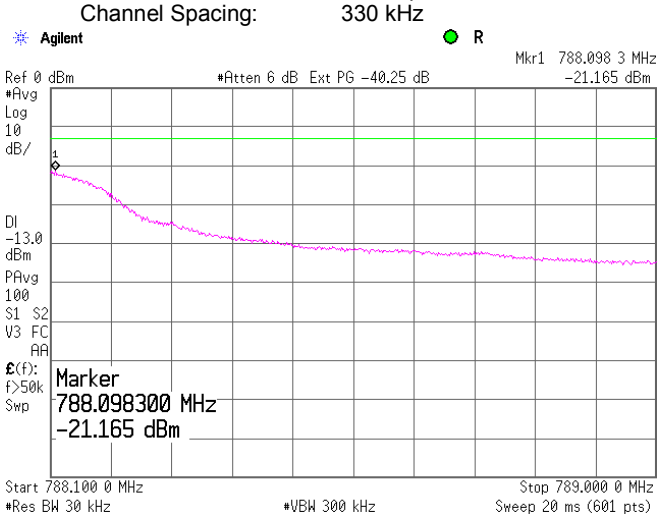
Frequency:	787.17 MHz
Band edge:	786.0 – 786.9 MHz
Modulation:	QPSK
Bit rate:	520 kbps
Channel Spacing:	330 kHz



Correction factor = 10log(100/30) = 5.23 dB

Plot 7.3.8 Spurious emissions at RF antenna connector, high channel band edge measurements

Frequency:	787.83 MHz
Band edge:	788.1 – 789.0 MHz
Modulation:	QPSK
Bit rate:	520 kbps
Channel Spacing:	330 kHz

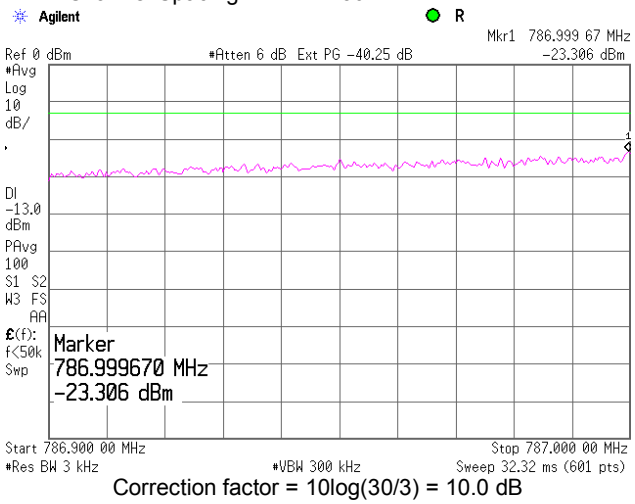


Correction factor = 10log(100/30) = 5.23 dB

Test specification:	**Section 27.53(c)(2), Spurious emissions at RF antenna connector**		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/09/2010 12:01:19 PM		
Temperature: 23.3 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 47 %	**Power Supply:** 12 VDC
Remarks: Band edges at 786-787 & 788-789 MHz bands			

Plot 7.3.9 Spurious emissions at RF antenna connector, low channel band edge measurements

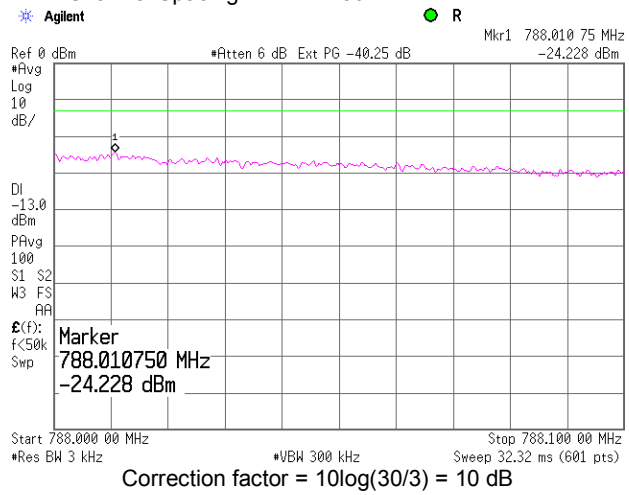
Frequency:	787.125 MHz
Band edge:	786.9 – 787.0 MHz
Modulation:	16QAM
Bit rate:	800 kbps
Channel Spacing:	250 kHz



Correction factor = 10log(30/3) = 10.0 dB

Plot 7.3.10 Spurious emissions at RF antenna connector, high channel band edge measurements

Frequency:	787.875 MHz
Band edge:	788.0 – 788.1 MHz
Modulation:	16QAM
Bit rate:	800 kbps
Channel Spacing:	250 kHz

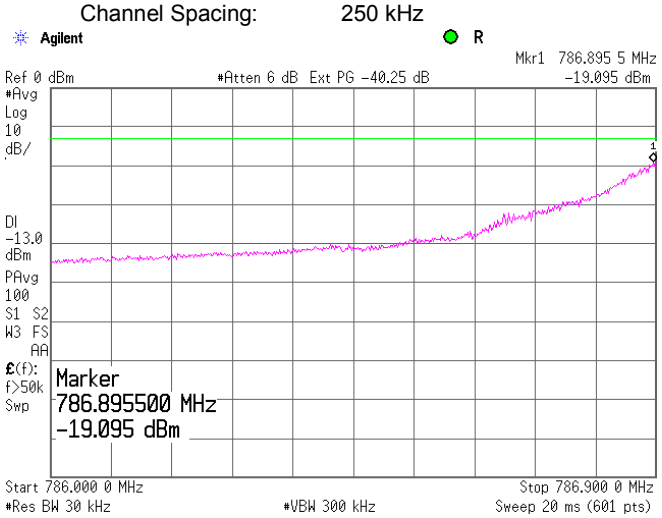


Correction factor = 10log(30/3) = 10 dB

Test specification:	Section 27.53(c)(2), Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/09/2010 12:01:19 PM		
Temperature: 23.3 ºC	Air Pressure: 1009 hPa	Relative Humidity: 47 %	Power Supply: 12 VDC
Remarks: Band edges at 786-787 & 788-789 MHz bands			

Plot 7.3.11 Spurious emissions at RF antenna connector, low channel band edge measurements

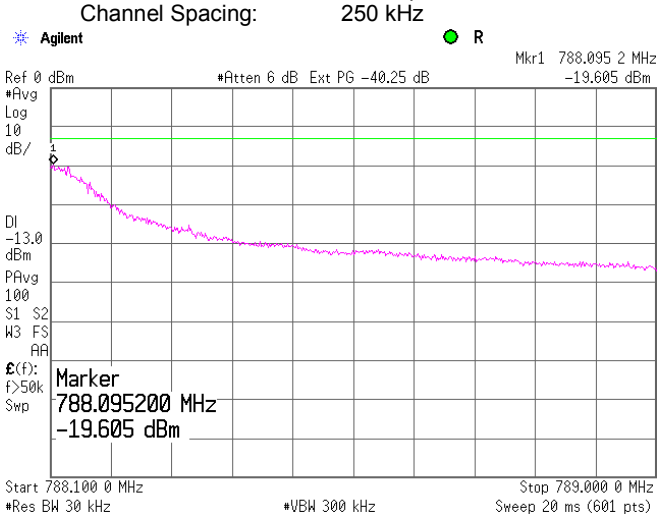
Frequency:	787.125 MHz
Band edge:	786.0 – 786.9 MHz
Modulation:	16QAM
Bit rate:	800 kbps
Channel Spacing:	250 kHz



Correction factor = 10log(100/30) = 5.23 dB

Plot 7.3.12 Spurious emissions at RF antenna connector, high channel band edge measurements

Frequency:	787.875 MHz
Band edge:	788.1 – 789.0 MHz
Modulation:	16QAM
Bit rate:	800 kbps
Channel Spacing:	250 kHz

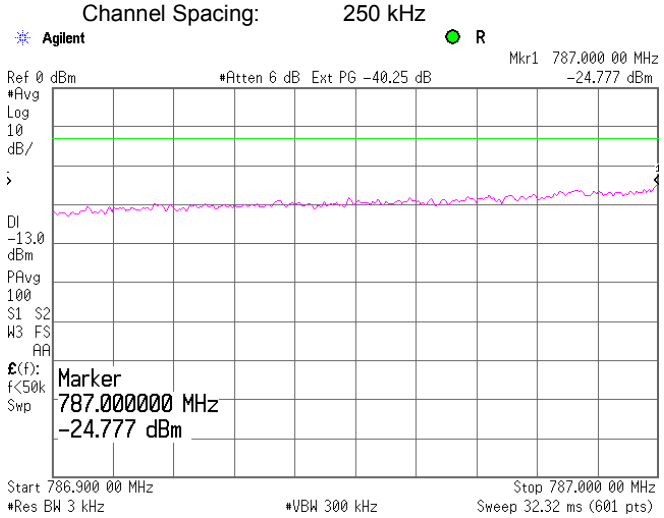


Correction factor = 10log(100/30) = 5.23 dB

Test specification:	Section 27.53(c)(2), Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/09/2010 12:01:19 PM		
Temperature: 23.3 ºC	Air Pressure: 1009 hPa	Relative Humidity: 47 %	Power Supply: 12 VDC
Remarks: Band edges at 786-787 & 788-789 MHz bands			

Plot 7.3.13 Spurious emissions at RF antenna connector, low channel band edge measurements

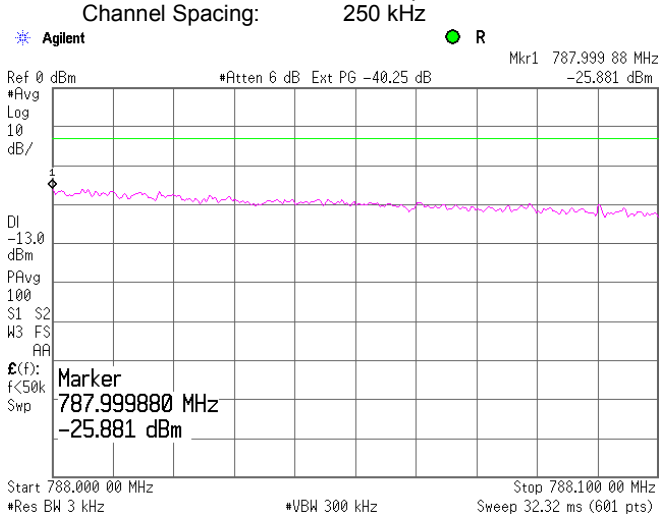
Frequency:	787.125 MHz
Band edge:	786.9 – 787.0 MHz
Modulation:	QPSK
Bit rate:	400 kbps
Channel Spacing:	250 kHz



Correction factor = 10log(30/3) = 10 dB

Plot 7.3.14 Spurious emissions at RF antenna connector, high channel band edge measurements

Frequency:	787.875 MHz
Band edge:	788.0 – 788.1 MHz
Modulation:	QPSK
Bit rate:	400 kbps
Channel Spacing:	250 kHz

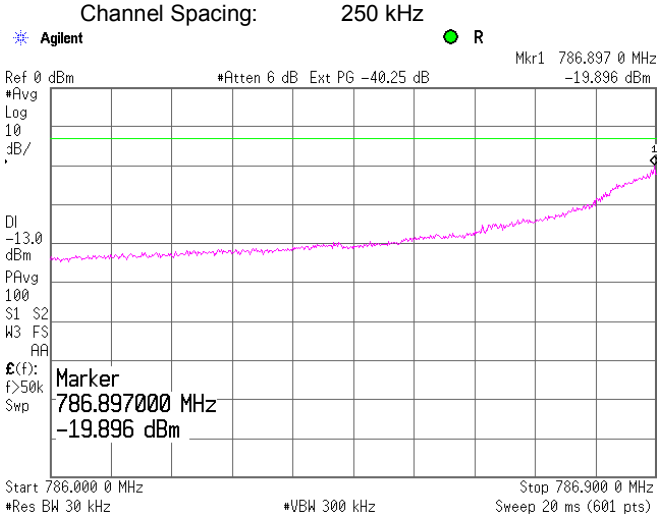


Correction factor = 10log(30/3) = 10 dB

Test specification:	Section 27.53(c)(2), Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/09/2010 12:01:19 PM		
Temperature: 23.3 ºC	Air Pressure: 1009 hPa	Relative Humidity: 47 %	Power Supply: 12 VDC
Remarks: Band edges at 786-787 & 788-789 MHz bands			

Plot 7.3.15 Spurious emissions at RF antenna connector, low channel band edge measurements

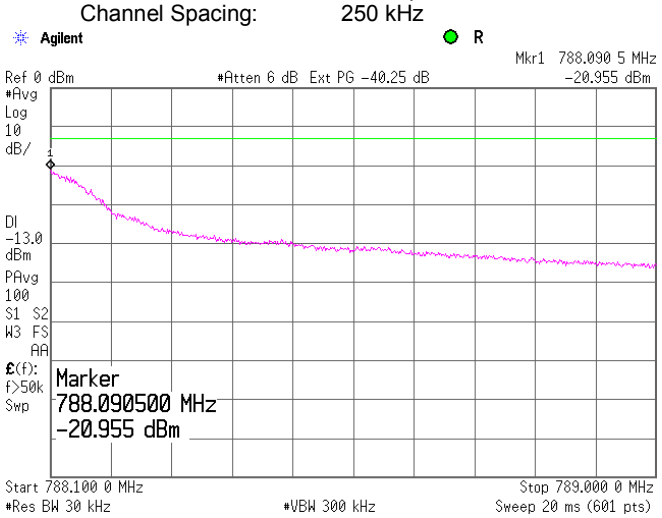
Frequency:	787.125 MHz
Band edge:	786.0 – 786.9 MHz
Modulation:	QPSK
Bit rate:	400 kbps
Channel Spacing:	250 kHz



Correction factor = 10log(100/30) = 5.23 dB

Plot 7.3.16 Spurious emissions at RF antenna connector, high channel band edge measurements

Frequency:	787. 875 MHz
Band edge:	788.1 – 789.0 MHz
Modulation:	QPSK
Bit rate:	400 kbps
Channel Spacing:	250 kHz



Correction factor = 10log(100/30) = 5.23 dB

Test specification:	Section 27.53(c)(2), Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/14/2010 12:03:02 PM		
Temperature: 24.2 ºC	Air Pressure: 1005 hPa	Relative Humidity: 56 %	Power Supply: 12 VDC
Remarks:			

7.4 Radiated spurious emission measurements

7.4.1 General

This test was performed to measure radiated spurious emissions from the EUT. Specification test limits are given in Table 7.4.1.

Table 7.4.1 Radiated spurious emission test limits

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

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

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

7.4.2.1 The EUT was set up as shown in Figure 7.4.1, energized and the performance check was conducted.
7.4.2.2 The specified frequency range was investigated with antenna connected to spectrum analyzer. To find maximum radiation the turntable was rotated 360^0 and the measuring antenna was rotated around its vertical axis.
7.4.2.3 The worst test results (the lowest margins) were recorded in Table 7.4.2 and shown in the associated plots.

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

7.4.3.1 The EUT was set up as shown in Figure 7.4.2, energized and the performance check was conducted.
7.4.3.2 The specified frequency range was investigated with antenna connected to spectrum analyzer. To find maximum radiation the turntable was rotated 360^0 and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal, polarizations.
7.4.3.3 The worst test results (the lowest margins) were recorded in Table 7.4.2 and shown in the associated plots.

Test specification:	Section 27.53(c)(2), Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/14/2010 12:03:02 PM		
Temperature: 24.2 ºC	Air Pressure: 1005 hPa	Relative Humidity: 56 %	Power Supply: 12 VDC
Remarks:			

Figure 7.4.1 Setup for spurious emission field strength measurements in 9 kHz to 30 MHz band

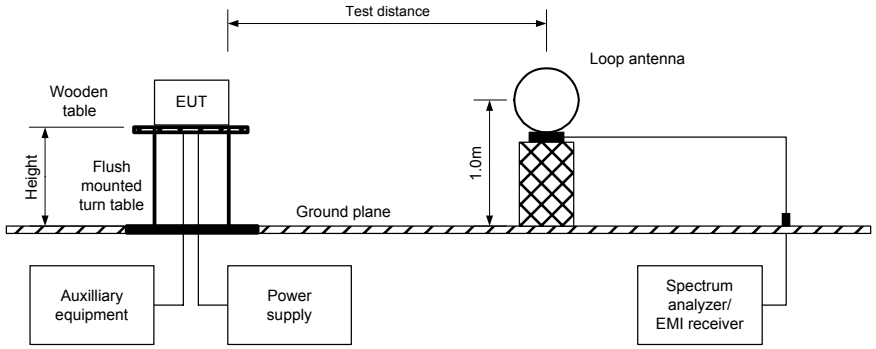
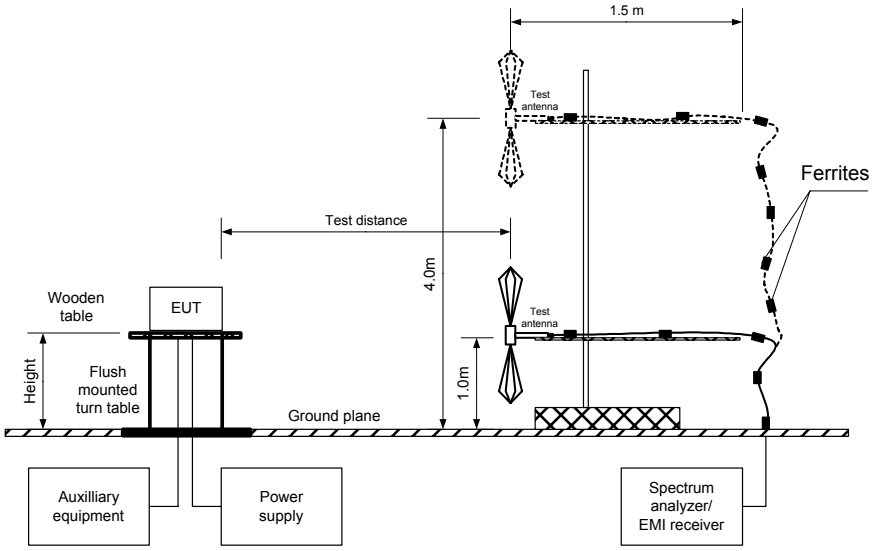


Figure 7.4.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:	**Section 27.53(c)(2), Radiated spurious emissions**		
Test procedure:	47 CFR, Section 2.1053, TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/14/2010 12:03:02 PM		
Temperature: 24.2 ºC	**Air Pressure:** 1005 hPa	**Relative Humidity:** 56 %	**Power Supply:** 12 VDC
Remarks:			

Table 7.4.2 Spurious emission field strength test results

ASSIGNED FREQUENCY RANGE: 787.0 – 788.0 MHz
TEST DISTANCE: 3 m
TEST SITE: Semi anechoic chamber
EUT HEIGHT: 0.8 m
INVESTIGATED FREQUENCY RANGE: 0.009 – 10000 MHz
DETECTOR USED: Peak
VIDEO BANDWIDTH: > Resolution bandwidth
TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
Biconilog (30 MHz – 1000 MHz)
Double ridged guide (above 1000 MHz)
MODULATION: QPSK (worst case output power)
MODULATING SIGNAL: PRBS
BIT RATE: 400 kbps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	Field strength, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees
All spurious were found at least 20 dB below equivalent field strength limit							

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

NOTE: Second harmonic of the carrier falls into 1559.0 – 1610.0 MHz range and was tested separately

Reference numbers of test equipment used

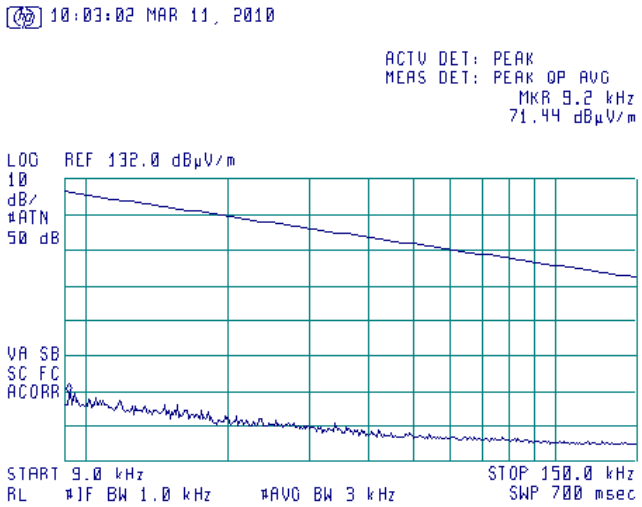
HL 0446	HL 0521	HL 0604	HL 1984	HL 3121	HL 3123	HL 3441	HL 3443
HL 3616	HL 3818	HL 3884					

Full description is given in Appendix A.

Test specification:	Section 27.53(c)(2), Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/14/2010 12:03:02 PM		
Temperature: 24.2 ºC	Air Pressure: 1005 hPa	Relative Humidity: 56 %	Power Supply: 12 VDC
Remarks:			

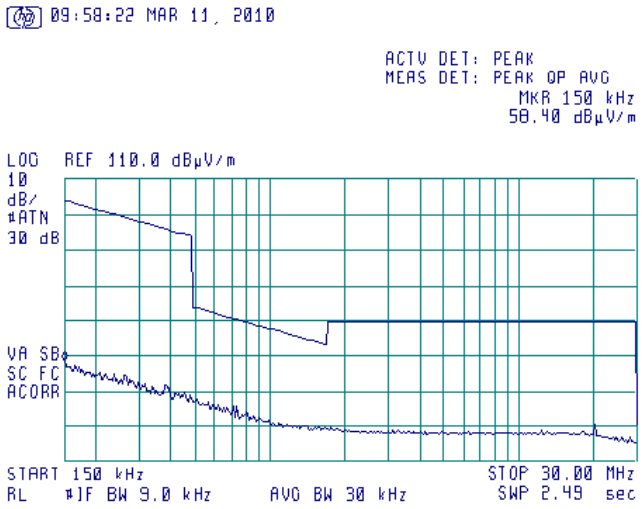
Plot 7.4.1 Radiated emission measurements in 9 - 150 kHz range

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



Plot 7.4.2 Radiated emission measurements in 0.15 - 30 MHz range

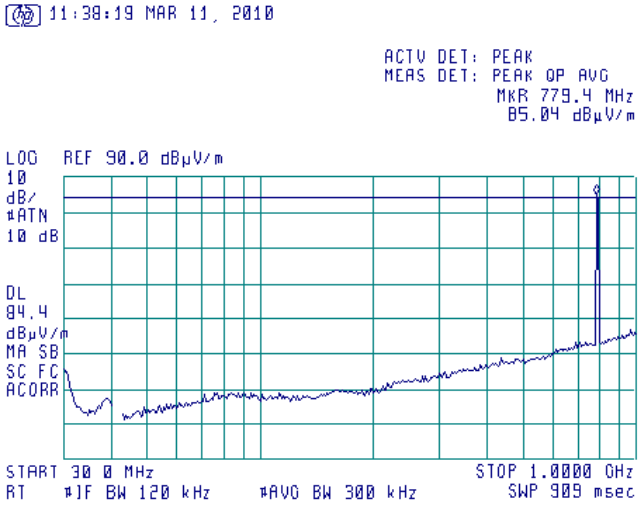
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 27.53(c)(2), Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/14/2010 12:03:02 PM		
Temperature: 24.2 ºC	Air Pressure: 1005 hPa	Relative Humidity: 56 %	Power Supply: 12 VDC
Remarks:			

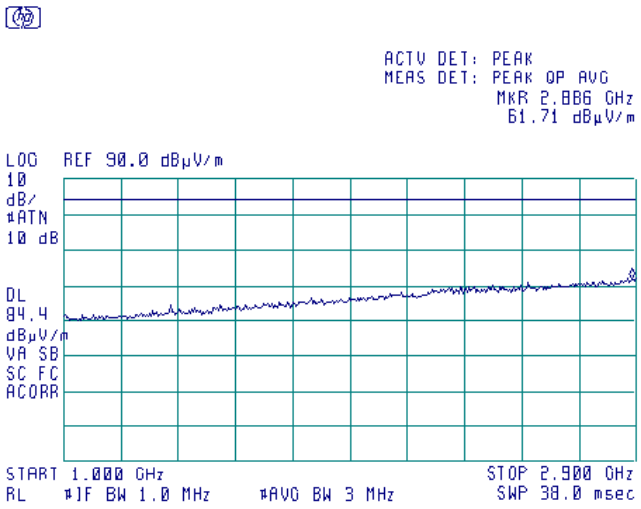
Plot 7.4.3 Radiated emission measurements in 30 - 1000 MHz range

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



Plot 7.4.4 Radiated emission measurements in 1000 – 2900 MHz range

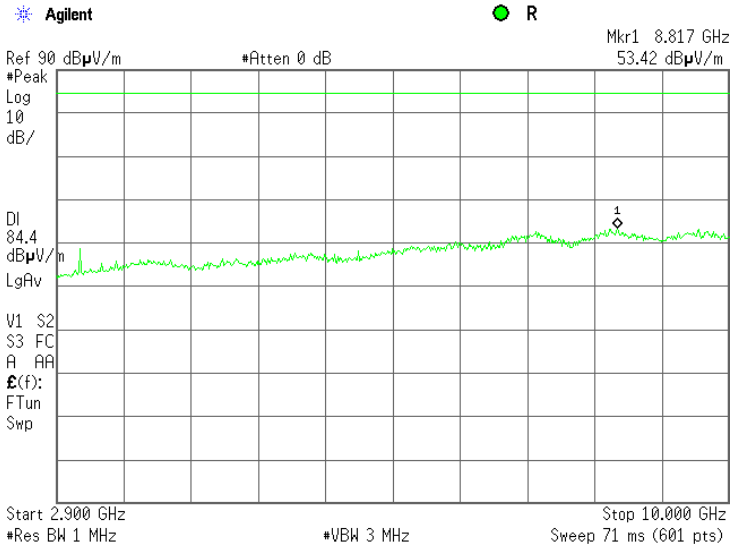
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 27.53(c)(2), Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/14/2010 12:03:02 PM		
Temperature: 24.2 ºC	Air Pressure: 1005 hPa	Relative Humidity: 56 %	Power Supply: 12 VDC
Remarks:			

Plot 7.4.5 Radiated emission measurements in 2900 – 10000 MHz range

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



Test specification:	Section 27.53(f), Radiated emissions in the 1559-1610 MHz band		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/14/2010 12:03:44 PM		
Temperature: 24.1 ºC	Air Pressure: 1005 hPa	Relative Humidity: 56 %	Power Supply: 12 VDC
Remarks:			

7.5 Radiated spurious emission measurements in 1559-1610 MHz band

7.5.1 General

This test was performed to measure radiated spurious emissions from the EUT enclosure with antenna. Specification test limits are given in Table 7.5.1

Table 7.5.1 Radiated spurious emission test limits

Frequency, MHz	Type of signal	EIRP of spurious emissions, dBW/MHz	Spurious emissions, dBm
1559 - 1610	Wideband	-70	-40
	Discrete or less than 700 Hz BW	-80	-50

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

7.5.2.1 The EUT was set up as shown in Figure 7.5.1, energized and the EUT performance was checked.

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

7.5.2.3 The worst test results with respect to the limits were recorded in Table 7.5.2 and shown in the associated plots.

7.5.3 Test procedure for substitution EIRP measurements of spurious

7.5.3.1 The test equipment was set up as shown in Figure 7.5.2 and energized.

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

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

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

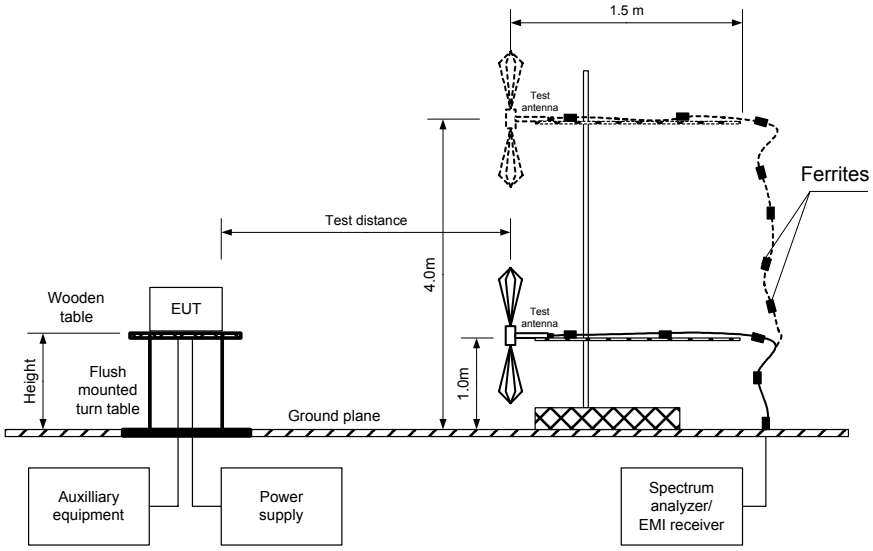
7.5.3.5 The EIRP of spurious emissions was calculated as a sum of signal generator output power in dBm and antenna gain in dBi reduced by cable loss in dB.

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

7.5.3.7 The worst test results (the lowest margins) were recorded in Table 7.5.2 and shown in the associated plots.

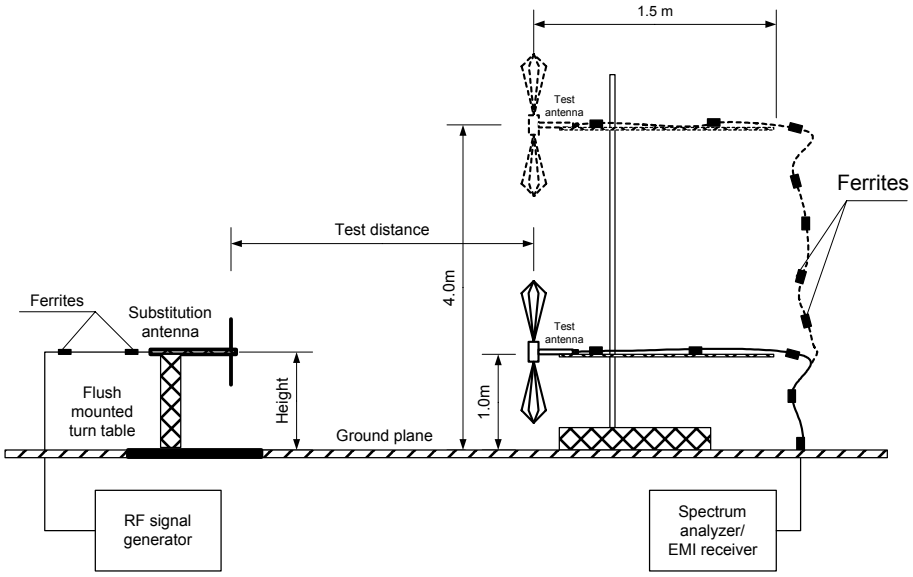
Test specification:	Section 27.53(f), Radiated emissions in the 1559-1610 MHz band		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/14/2010 12:03:44 PM		
Temperature: 24.1 ºC	Air Pressure: 1005 hPa	Relative Humidity: 56 %	Power Supply: 12 VDC
Remarks:			

Figure 7.5.1 Setup for spurious emission field strength measurements



Test specification:	Section 27.53(f), Radiated emissions in the 1559-1610 MHz band		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/14/2010 12:03:44 PM		
Temperature: 24.1 ºC	Air Pressure: 1005 hPa	Relative Humidity: 56 %	Power Supply: 12 VDC
Remarks:			

Figure 7.5.2 Setup for substitution EIRP measurements of spurious



Test specification:	Section 27.53(f), Radiated emissions in the 1559-1610 MHz band		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/14/2010 12:03:44 PM		
Temperature: 24.1 ºC	Air Pressure: 1005 hPa	Relative Humidity: 56 %	Power Supply: 12 VDC
Remarks:			

Table 7.5.2 Substitution EIRP of spurious test results

ASSIGNED FREQUENCY RANGE: 787.0 – 788.0 MHz
TRANSMITTER CARRIER ERP: 28.23 dBm at mid frequency
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
SUBSTITUTION ANTENNA HEIGHT: 0.8 m
DETECTOR USED: Peak
VIDEO BANDWIDTH: > Resolution bandwidth
SUBSTITUTION ANTENNA TYPE: Tunable dipole (30 MHz – 1000 MHz)
Double ridged guide (above 1000 MHz)

Frequency, MHz	Field strength, dB(µV/m)	RBW, kHz	Antenna polarization	RF generator output, dBm	Ant gain, dBi	Cable loss, dB	EIRP, dBm	Limit, dBm	Margin, dB*	Verdict
EUT Antenna: Vertical										
Mid carrier frequency 787.375 MHz										
1575.275	57.61	1000	H	-44.98	8.66	3.94	-40.26	-40.00	-0.26	Pass
1575.173	57.10	1000	V	-46.32	8.66	3.94	-41.60	-40.00	-1.60	
EUT Antenna: Horizontal										
Mid carrier frequency 787.375 MHz										
1575.263	55.73	1000	H	-46.86	8.66	3.94	-42.14	-40.00	-2.14	Pass
1575.260	57.87	1000	V	-45.55	8.66	3.94	-40.83	-40.00	-0.83	

*- Margin = Spurious emission – specification limit.
Note: The second harmonic spurious emission was defined as a wideband emission because the spurious bandwidth was found more than 700 Hz.

Reference numbers of test equipment used

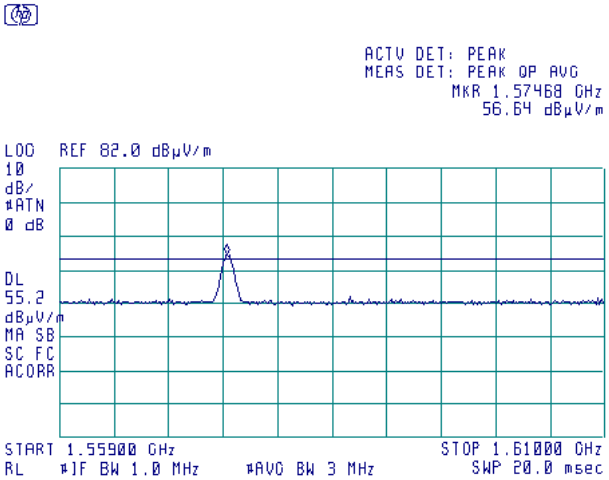
HL 0521	HL 0557	HL 1984	HL 3042	HL 3121	HL 3123	HL 3341	HL 3386
HL 3616							

Full description is given in Appendix A.

Test specification:	**Section 27.53(f), Radiated emissions in the 1559-1610 MHz band**		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/14/2010 12:03:44 PM		
Temperature: 24.1 ºC	**Air Pressure:** 1005 hPa	**Relative Humidity:** 56 %	**Power Supply:** 12 VDC
Remarks:			

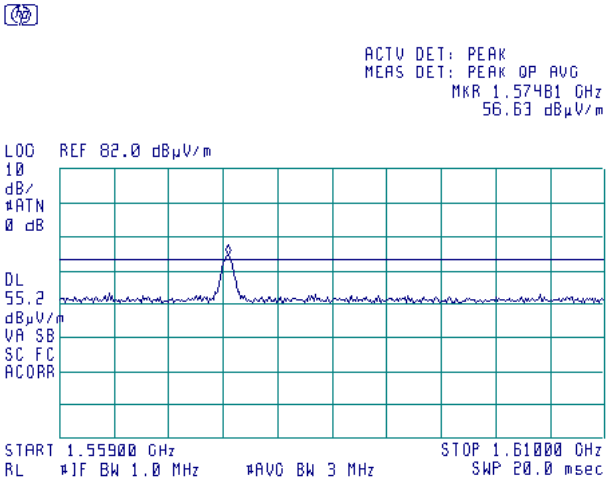
Plot 7.5.1 Radiated emission measurements in 1559 - 1610 MHz range

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
RBW/VBW:	1000/3000 kHz
EUT ANTENNA:	Vertical



Plot 7.5.2 Radiated emission measurements in 1559 - 1610 MHz range

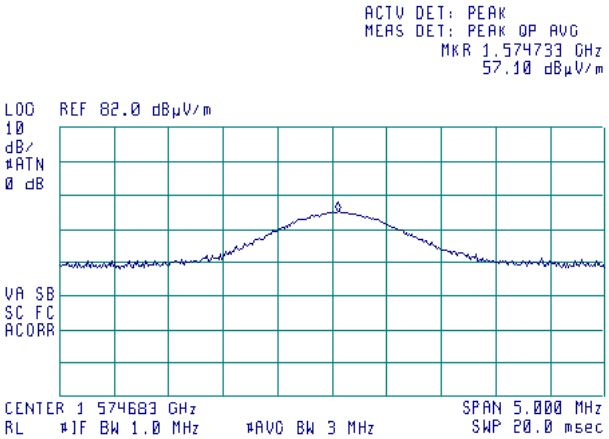
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
RBW/VBW:	1000/3000 kHz
EUT ANTENNA:	Horizontal



Test specification:	Section 27.53(f), Radiated emissions in the 1559-1610 MHz band		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/14/2010 12:03:44 PM		
Temperature: 24.1 ºC	Air Pressure: 1005 hPa	Relative Humidity: 56 %	Power Supply: 12 VDC
Remarks:			

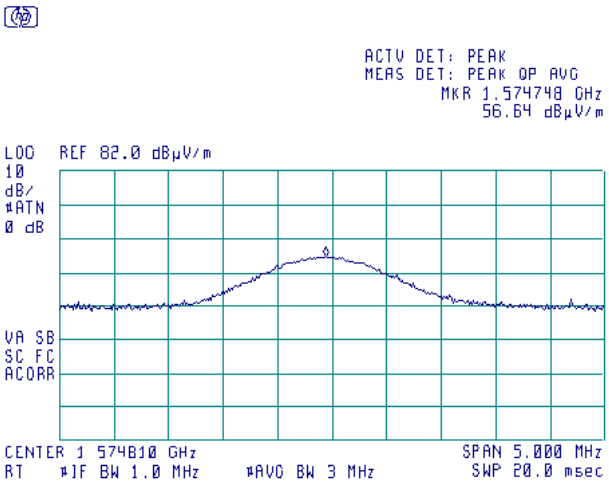
Plot 7.5.3 Radiated emission measurements at the 2nd harmonic

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m
EUT ANTENNA:	Vertical



Plot 7.5.4 Radiated emission measurements at the 2nd harmonic

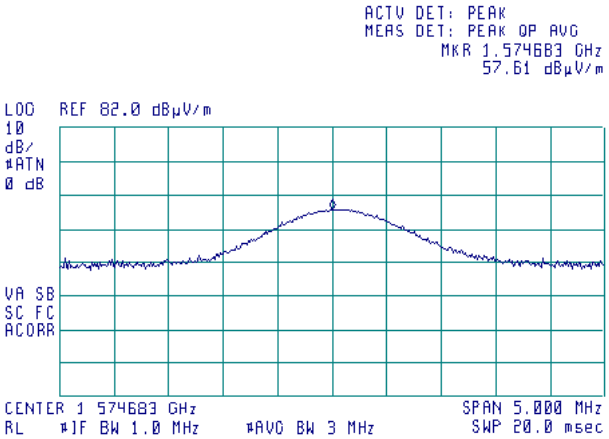
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m
EUT ANTENNA:	Horizontal



Test specification:	Section 27.53(f), Radiated emissions in the 1559-1610 MHz band		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/14/2010 12:03:44 PM		
Temperature: 24.1 ºC	Air Pressure: 1005 hPa	Relative Humidity: 56 %	Power Supply: 12 VDC
Remarks:			

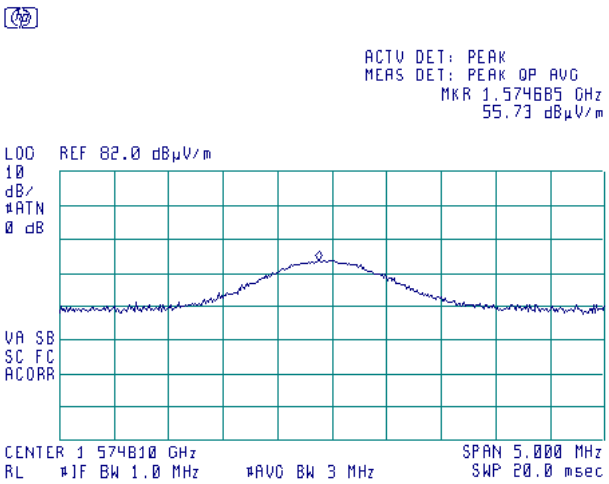
Plot 7.5.5 Radiated emission measurements at the 2nd harmonic

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m
EUT ANTENNA:	Vertical



Plot 7.5.6 Radiated emission measurements at the 2nd harmonic

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m
EUT ANTENNA:	Horizontal



Test specification:	Section 27.53(c)(3), Spurious emissions at RF antenna connector in 763-775 MHz and 793 – 805 MHz		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/09/2010 12:02:14 PM		
Temperature: 23.4 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 47 %	**Power Supply:** 12 VDC
Remarks:			

7.6 Spurious emissions at RF antenna connector test in 763 – 775 MHz and 793 – 805 MHz

7.6.1 General

This test was performed to measure spurious emissions at RF antenna connector. Specification test limits are given in Table 7.6.1.

Table 7.6.1 Spurious emission limits

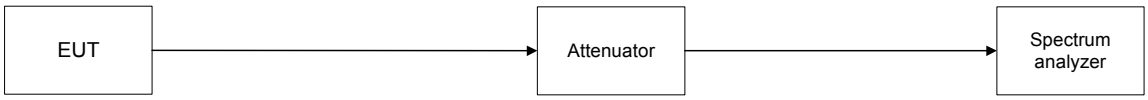
Frequency, MHz*	Attenuation below carrier, dBc	Spurious emissions, dBm
763 – 775 MHz	76+10logP*	-46
793 – 805 MHz	76+10logP*	-46

* - P is transmitter output power in Watts.

7.6.2 Test procedure

7.6.2.1 The EUT was set up as shown in Figure 7.6.1, energized and its proper operation was checked.
7.6.2.2 The EUT was adjusted to produce maximum available for end user RF output power.
7.6.2.3 The spurious emission was measured with spectrum analyzer as provided in Table 7.6.2 and the associated plots.

Figure 7.6.1 Spurious emission test setup



Test specification:	**Section 27.53(c)(3), Spurious emissions at RF antenna connector in 763-775 MHz and 793 – 805 MHz**		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/09/2010 12:02:14 PM		
Temperature: 23.4 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 47 %	**Power Supply:** 12 VDC
Remarks:			

Table 7.6.2 Spurious emission test results

ASSIGNED FREQUENCY RANGE: 787.0 – 788.0 MHz
INVESTIGATED FREQUENCY RANGE: 763 – 775 MHz, 793 – 805 MHz
DETECTOR USED: Peak
VIDEO BANDWIDTH: ≥ Resolution bandwidth
MODULATING SIGNAL: PRBS
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
MODULATION: QPSK (worst case output power)

Frequency, MHz	Channel Spacing, kHz	RBW, kHz	Spurious emission, dBm	Limit, dBm	Margin, dB*	Verdict
Low channel						
763 – 775	250	6.8	-61.24	-46.00	-15.24	Pass
763 – 775	330	6.8	-61.88	-46.00	-15.88	Pass
High channel						
793 - 805	250	6.8	-61.63	-46.00	-15.63	Pass
793 - 805	330	6.8	-61.78	-46.00	-15.78	Pass

*- Margin = Spurious emission – specification limit.

Reference numbers of test equipment used

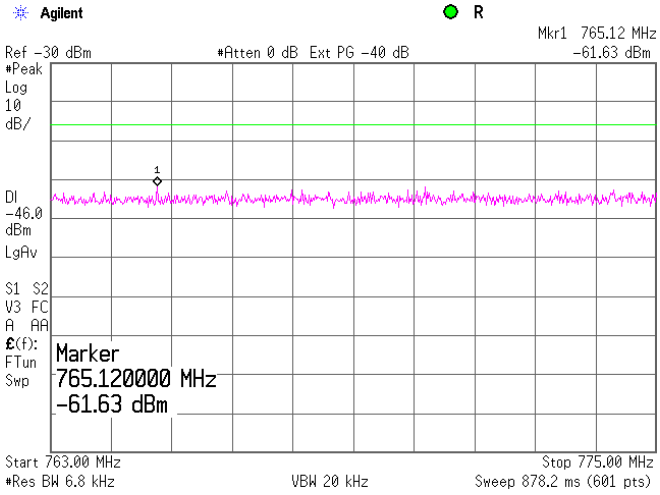
HL 2951	HL 3442	HL 3762	HL 3818				

Full description is given in Appendix A.

Test specification:	**Section 27.53(c)(3), Spurious emissions at RF antenna connector in 763-775 MHz and 793 – 805 MHz**		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/09/2010 12:02:14 PM		
Temperature: 23.4 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 47 %	**Power Supply:** 12 VDC
Remarks:			

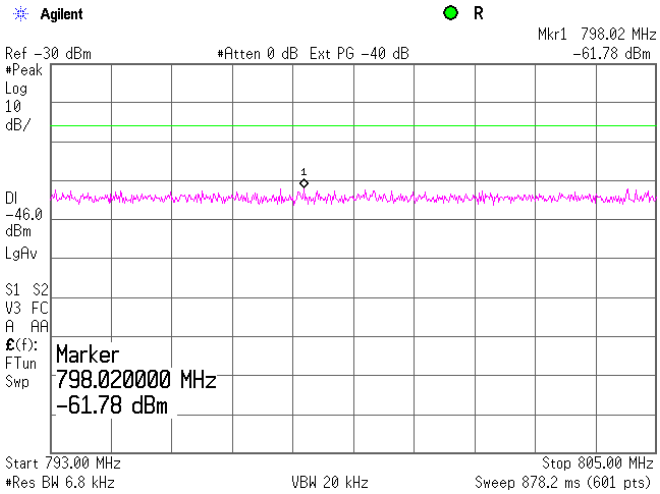
Plot 7.6.1 Spurious emission test results at low frequency, 330 kHz channel spacing

Frequency range 763 – 775 MHz
Bit rate: 520 kbps
Modulation: QPSK



Plot 7.6.2 Spurious emission test results at high frequency, 330 kHz channel spacing

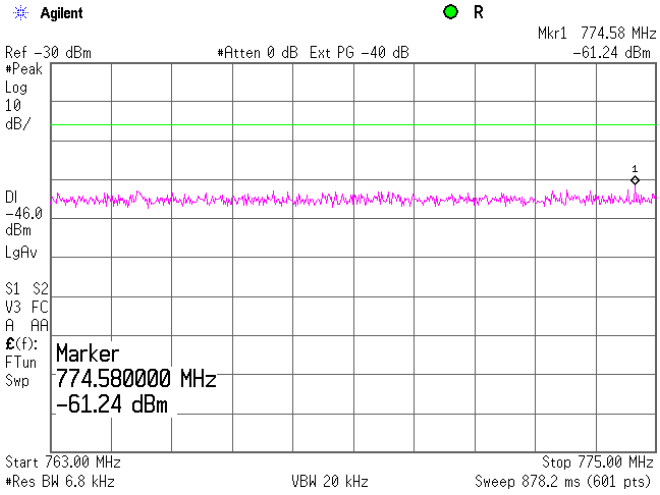
Frequency range 793 – 805 MHz
Bit rate: 520 kbps
Modulation: QPSK



Test specification:	**Section 27.53(c)(3), Spurious emissions at RF antenna connector in 763-775 MHz and 793 – 805 MHz**		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/09/2010 12:02:14 PM		
Temperature: 23.4 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 47 %	**Power Supply:** 12 VDC
Remarks:			

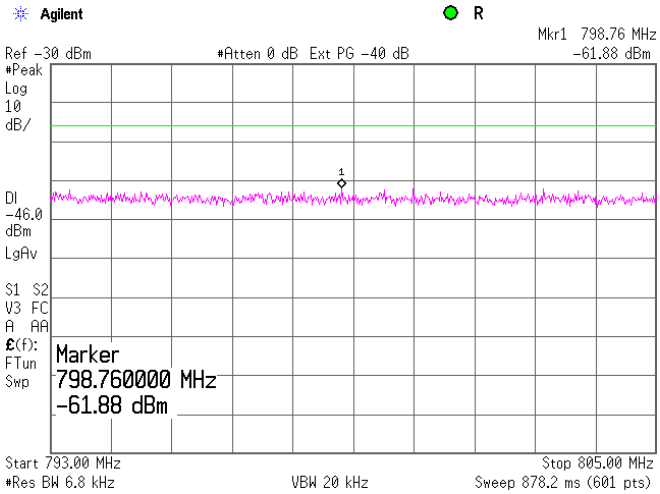
Plot 7.6.3 Spurious emission test results at low frequency, 250 kHz channel spacing

Frequency range 763 – 775 MHz
Bit rate: 400 kbps
Modulation: QPSK



Plot 7.6.4 Spurious emission test results at high frequency, 250 kHz channel spacing

Frequency range 793 – 805 MHz
Bit rate: 400 kbps
Modulation: QPSK



Test specification:	Section 27.53(c)(2), Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/09/2010 12:02:42 PM		
Temperature: 23.4 ºC	Air Pressure: 1009 hPa	Relative Humidity: 47 %	Power Supply: 12 VDC
Remarks:			

7.7 Spurious emissions at RF antenna connector test

7.7.1 General

This test was performed to measure spurious emissions at RF antenna connector. Specification test limits are given in Table 7.7.1.

Table 7.7.1 Spurious emission limits

Frequency, MHz	Attenuation below carrier, dBc	ERP of spurious, dBm
0.009 – 10th harmonic	43+10logP*	-13.0

* - P is transmitter output power in Watts

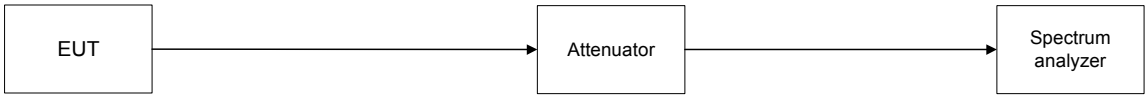
7.7.2 Test procedure

7.7.2.1 The EUT was set up as shown Figure 7.7.1, energized and its proper operation was checked.

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

7.7.2.3 The spurious emission was measured with spectrum analyzer as provided in Table 7.7.2, Table 7.7.3 and the associated plots.

Figure 7.7.1 Spurious emission test setup



Test specification:	**Section 27.53(c)(2), Spurious emissions at RF antenna connector**		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/09/2010 12:02:42 PM		
Temperature: 23.4 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 47 %	**Power Supply:** 12 VDC
Remarks:			

Table 7.7.2 Spurious emission test results

ASSIGNED FREQUENCY RANGE: 787.00 – 788.00 MHz
INVESTIGATED FREQUENCY RANGE: 0.009 – 8000 MHz
DETECTOR USED: Average
VIDEO BANDWIDTH: ≥ Resolution bandwidth
MODULATION: QPSK (worst case of output power)
MODULATING SIGNAL: PRBS
BIT RATE: 400 kbps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
CHANNEL SPACING: 250 kHz
TRANSMITTER OUTPUT POWER: 29.05 dBm at mid frequency

Frequency, MHz	SA reading, dBm	Attenuator, dB	Cable loss, dB	RBW, kHz	Spurious emission, dBm	Attenuation below carrier, dBc	Limit, dBc	Margin, dB*	Verdict
Mid carrier frequency									
1574.75	-41.655	Included	Included	100	-41.66	70.71	42.05	-32.66	Pass

*- Margin = Spurious emission – specification limit.

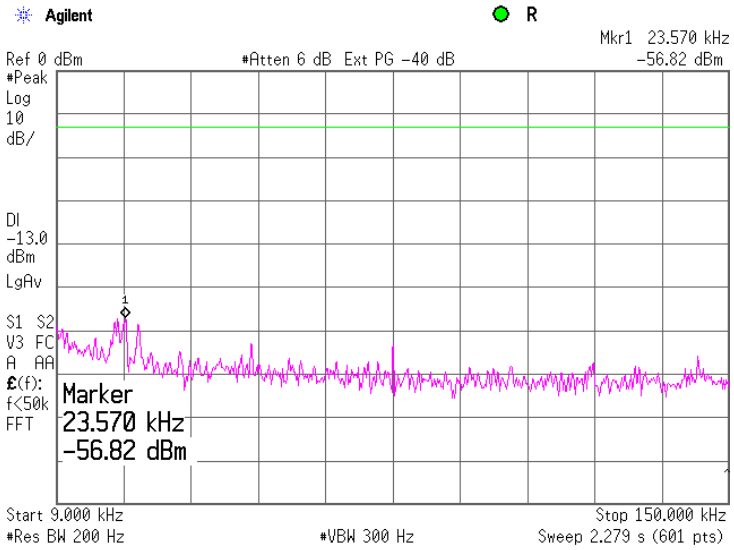
Reference numbers of test equipment used

HL 2951	HL 3442	HL 3762	HL 3818				

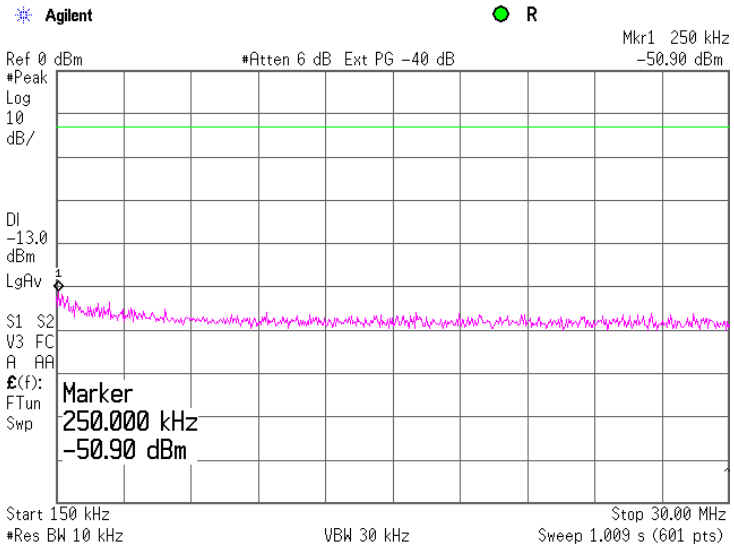
Full description is given in Appendix A.

Test specification:	Section 27.53(c)(2), Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/09/2010 12:02:42 PM		
Temperature: 23.4 ºC	Air Pressure: 1009 hPa	Relative Humidity: 47 %	Power Supply: 12 VDC
Remarks:			

Plot 7.7.1 Spurious emission measurements in 9 - 150 kHz range at mid carrier frequency, 250 kHz channel spacing

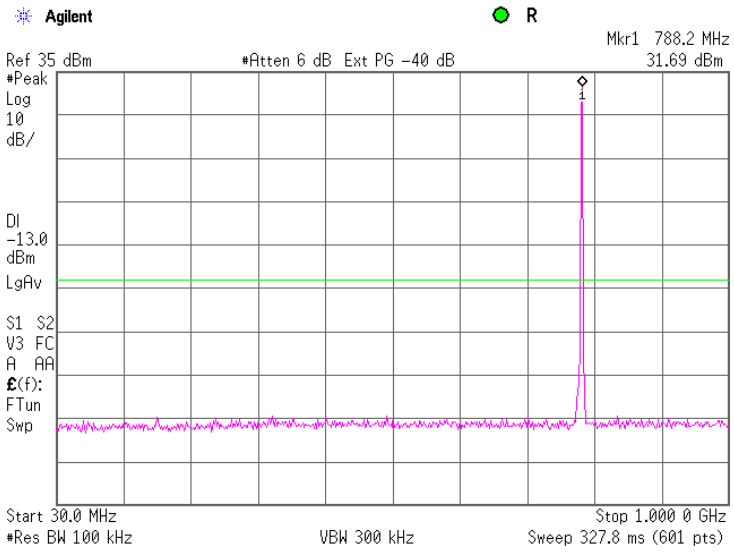


Plot 7.7.2 Spurious emission measurements in 0.15 - 30.0 MHz range at mid carrier frequency, 250 kHz channel spacing

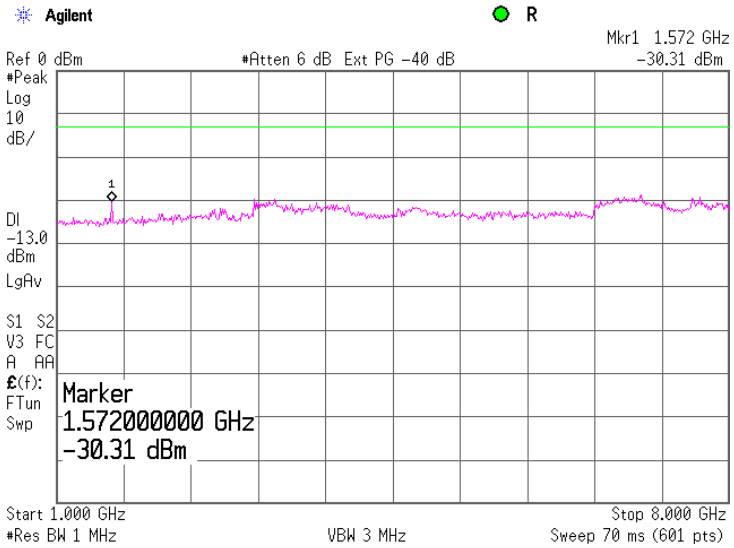


Test specification:	Section 27.53(c)(2), Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/09/2010 12:02:42 PM		
Temperature: 23.4 ºC	Air Pressure: 1009 hPa	Relative Humidity: 47 %	Power Supply: 12 VDC
Remarks:			

Plot 7.7.3 Spurious emission measurements in 30 - 1000 MHz range at mid carrier frequency, 250 kHz channel spacing

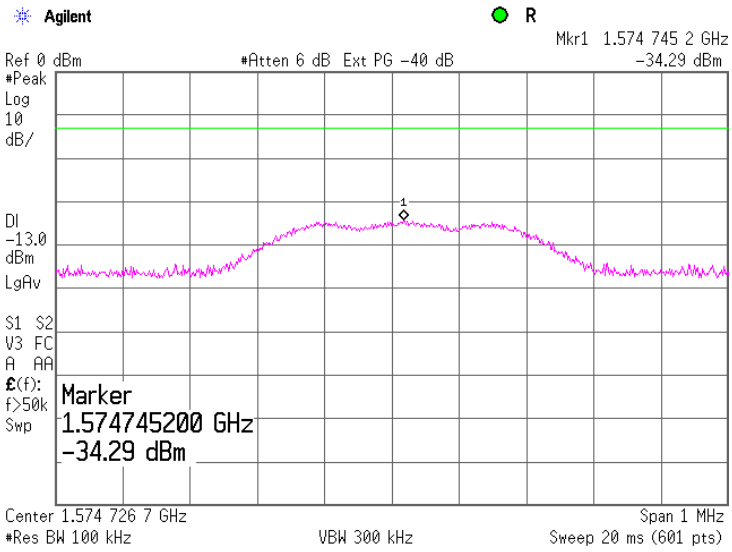


Plot 7.7.4 Spurious emission measurements in 1000 - 8000 MHz at mid carrier frequency, 250 kHz channel spacing

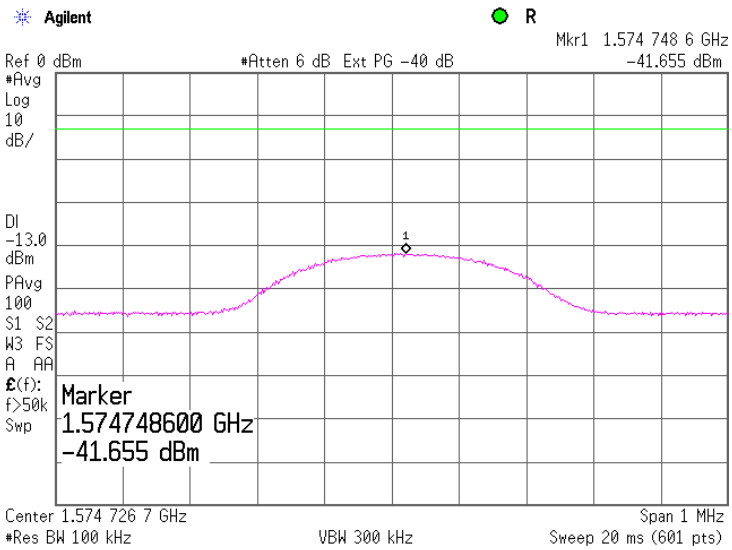


Test specification:	Section 27.53(c)(2), Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/09/2010 12:02:42 PM		
Temperature: 23.4 ºC	Air Pressure: 1009 hPa	Relative Humidity: 47 %	Power Supply: 12 VDC
Remarks:			

Plot 7.7.5 Spurious emission measurements at second harmonic of mid carrier frequency, 250 kHz channel spacing, peak detector



Plot 7.7.6 Spurious emission measurements at second harmonic of mid carrier frequency, 250 kHz channel spacing, average detector



Test specification:	**Section 27.53(c)(2), Spurious emissions at RF antenna connector**		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/09/2010 12:02:42 PM		
Temperature: 23.4 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 47 %	**Power Supply:** 12 VDC
Remarks:			

Table 7.7.3 Spurious emission test results

ASSIGNED FREQUENCY RANGE: 787.00 – 788.00 MHz
INVESTIGATED FREQUENCY RANGE: 0.009 – 8000 MHz
DETECTOR USED: Average
VIDEO BANDWIDTH: ≥ Resolution bandwidth
MODULATION: QPSK (worst case of output power)
MODULATING SIGNAL: PRBS
BIT RATE: 520 kbps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
CHANNEL SPACING: 330 kHz
TRANSMITTER OUTPUT POWER: 28.87 dBm at mid frequency

Frequency, MHz	SA reading, dBm	Attenuator, dB	Cable loss, dB	RBW, kHz	Spurious emission, dBm	Attenuation below carrier, dBc	Limit, dBc	Margin, dB*	Verdict
Mid carrier frequency									
1575.000	-43.12	Included	Included	100	-43.12	71.99	41.87	-30.12	Pass

*- Margin = Spurious emission – specification limit.

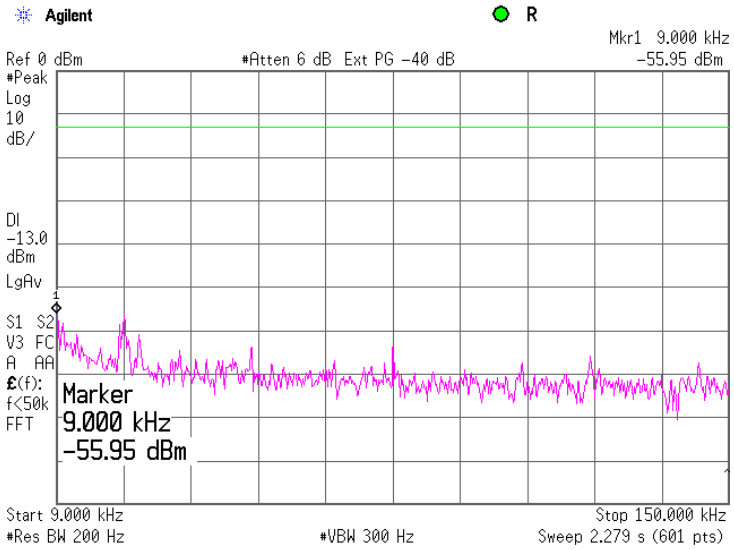
Reference numbers of test equipment used

HL 2951	HL 3442	HL 3762	HL 3818				

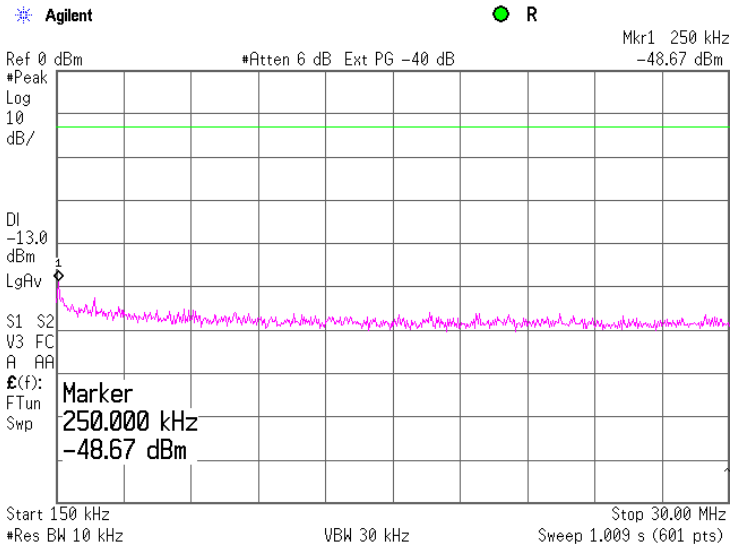
Full description is given in Appendix A.

Test specification:	Section 27.53(c)(2), Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/09/2010 12:02:42 PM		
Temperature: 23.4 ºC	Air Pressure: 1009 hPa	Relative Humidity: 47 %	Power Supply: 12 VDC
Remarks:			

Plot 7.7.7 Spurious emission measurements in 9 - 150 kHz range at mid carrier frequency, 330 kHz channel spacing

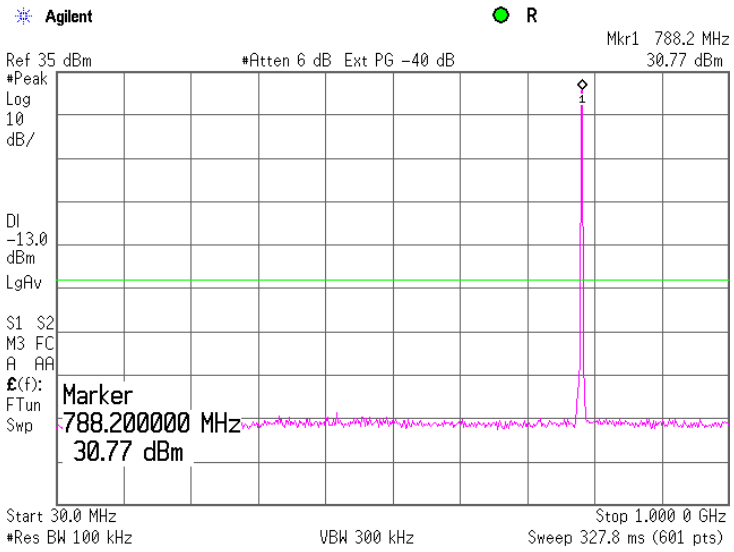


Plot 7.7.8 Spurious emission measurements in 0.15 - 30.0 MHz range at mid carrier frequency, 330 kHz channel spacing

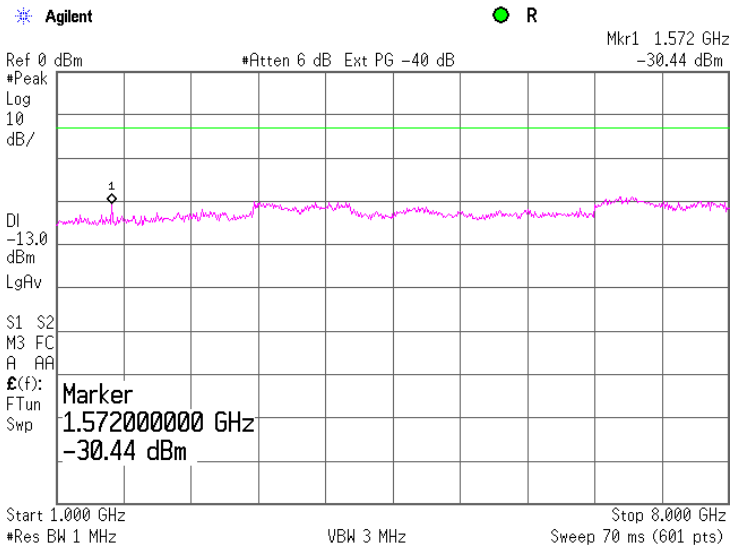


Test specification:	Section 27.53(c)(2), Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/09/2010 12:02:42 PM		
Temperature: 23.4 ºC	Air Pressure: 1009 hPa	Relative Humidity: 47 %	Power Supply: 12 VDC
Remarks:			

Plot 7.7.9 Spurious emission measurements in 30.0 - 1000 MHz range at mid carrier frequency, 330 kHz channel spacing

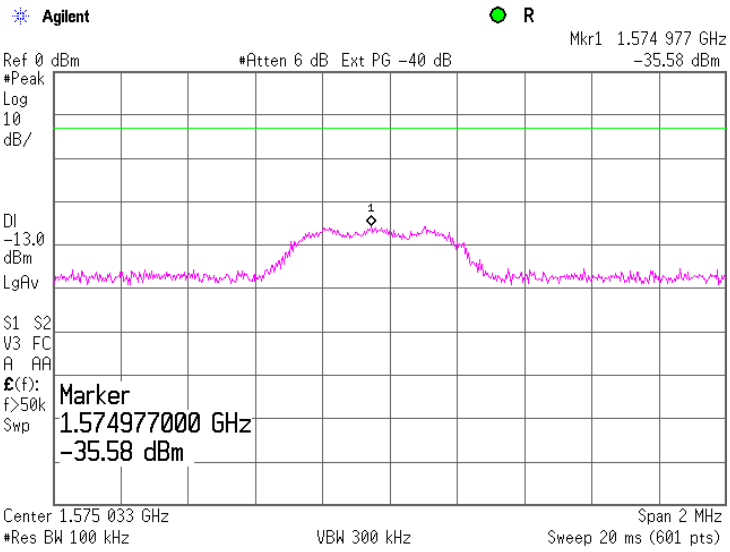


Plot 7.7.10 Spurious emission measurements in 1000 - 8000 MHz at mid carrier frequency, 330 kHz channel spacing

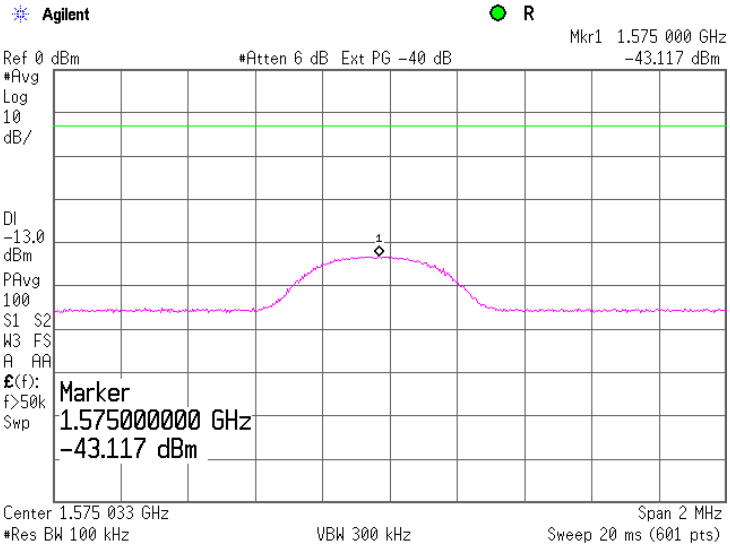


Test specification:	Section 27.53(c)(2), Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1047, 2.1051, TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/09/2010 12:02:42 PM		
Temperature: 23.4 ºC	Air Pressure: 1009 hPa	Relative Humidity: 47 %	Power Supply: 12 VDC
Remarks:			

Plot 7.7.11 Spurious emission measurements at second harmonic of mid carrier frequency, 330 kHz channel spacing, peak detector



Plot 7.7.12 Spurious emission measurements at second harmonic of mid carrier frequency, 330 kHz channel spacing, average detector



Test specification:	Section 27.54, Frequency stability		
Test procedure:	47 CFR, Section 2.1055, TIA/EIA-603-C, Section 2.2.2		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/15/2010 12:04:04 PM		
Temperature: 22.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 51 %	Power Supply: 12 VDC
Remarks:			

7.8 Frequency stability test

7.8.1 General

This test was performed to measure frequency stability of transmitter RF carrier. Specification test limits are given in Table 7.8.1.

Table 7.8.1 Frequency stability limits

Assigned frequency, MHz	Maximum allowed frequency displacement
787.0 – 788.0	26 dBc points including frequency tolerance shall remain within the assigned band

7.8.2 Test procedure

7.8.2.1 The EUT was set up as shown in Figure 7.8.1, energized and its proper operation was checked.

7.8.2.2 The EUT power was turned off. Temperature within test chamber was set to +30˚C and a period of time sufficient to stabilize all of the oscillator circuit components was allowed.

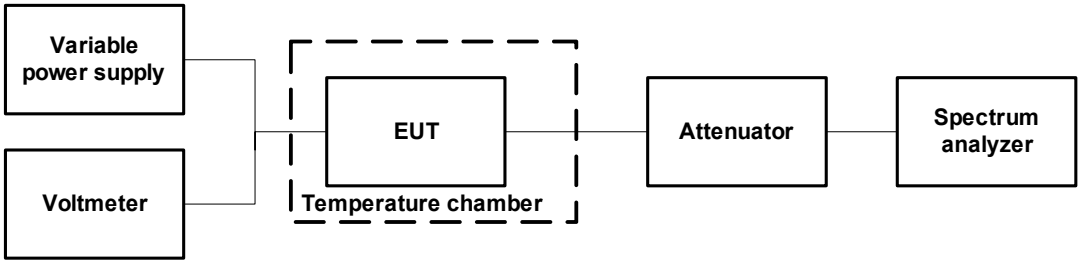
7.8.2.3 The EUT was powered on and carrier frequency was measured at start up moment and then every minute until frequency had been stabilized or 10 minutes elapsed whichever reached the last. The EUT was powered off.

7.8.2.4 The above procedure was repeated at 0˚C and at the lowest test temperature.

7.8.2.5 The EUT was powered on and carrier frequency was measured at start up moment and at the end of stabilization period at the rest of test temperatures and voltages. The EUT was powered off.

7.8.2.6 Frequency displacement was calculated as provided in Table 7.8.2 and Table 7.8.3.

Figure 7.8.1 Frequency stability test setup



Test specification:	**Section 27.54, Frequency stability**		
Test procedure:	47 CFR, Section 2.1055, TIA/EIA-603-C, Section 2.2.2		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/15/2010 12:04:04 PM		
Temperature: 22.4 ºC	**Air Pressure:** 1008 hPa	**Relative Humidity:** 51 %	**Power Supply:** 12 VDC
Remarks:			

Table 7.8.2 Frequency stability test results

ASSIGNED FREQUENCY RANGE:	787.0 – 788.0 MHz
NOMINAL POWER VOLTAGE:	12 VDC
TEMPERATURE STABILIZATION PERIOD:	20 min
POWER DURING TEMPERATURE TRANSITION:	Off
RESOLUTION BANDWIDTH:	1000 Hz
VIDEO BANDWIDTH:	1000 Hz
FREQUENCY SPAN:	5000 Hz
SPECTRUM ANALYZER MODE:	Counter
MODULATION:	Unmodulated

T, ºC	Voltage, V	Frequency, MHz							Max frequency drift, Hz		Max frequency drift,ppm	
		Start up	1st min	2nd min	3rd min	4th min	5th min	10th min	Positive	Negative	Positive	Negative
787.5 MHz												
-30	nominal	787.50088	787.50084	787.50082	787.50081	787.50080	787.50079	787.500775	1291.00	0.00	1.64	0.00
-20	nominal	787.50052	NA	NA	NA	NA	NA	787.500414	937.00	0.00	1.19	0.00
-10	nominal	787.50035	NA	NA	NA	NA	NA	787.500287	764.00	0.00	0.97	0.00
0	nominal	787.50001	787.50009	787.50006	787.50003	787.50002	787.50006	787.500000	501.00	0.00	0.64	0.00
10	nominal	787.49999	NA	NA	NA	NA	NA	787.499944	402.00	0.00	0.51	0.00
20	15%	787.49965	NA	NA	NA	NA	NA	787.499551	68.00	-34.00	0.09	-0.04
20	nominal	787.49970	NA	NA	NA	NA	NA	787.49959*	118.00	0.00	0.15	0.00
20	-15%	787.49968	NA	NA	NA	NA	NA	787.499557	92.00	-28.00	0.12	-0.04
30	nominal	787.49982	787.49975	787.49970	787.49965	787.49959	787.49957	787.499247	237.00	-338.0	0.30	-0.43
40	nominal	787.49917	NA	NA	NA	NA	NA	787.498670	0.00	-915.0	0.00	-1.16
50	nominal	787.49851	787.49854	787.49858	787.49860	787.49861	787.49863	787.498683	0.00	-1074	0.00	-1.36

* - Reference frequency

Test specification:	**Section 27.54, Frequency stability**		
Test procedure:	47 CFR, Section 2.1055, TIA/EIA-603-C, Section 2.2.2		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/15/2010 12:04:04 PM		
Temperature: 22.4 ºC	**Air Pressure:** 1008 hPa	**Relative Humidity:** 51 %	**Power Supply:** 12 VDC
Remarks:			

Table 7.8.3 Transmitter operating range including frequency drift

ASSIGNED FREQUENCY RANGE:	787.0 – 788.0 MHz
NOMINAL POWER VOLTAGE:	12 VDC
RESOLUTION BANDWIDTH:	0.5 – 2 % of emission bandwidth
VIDEO BANDWIDTH:	> RBW
FREQUENCY SPAN:	500 kHz
MODULATION:	Enabled

Channel, MHz	Modulation	Channel Bandwidth, kHz	Band Edge	Measured* band edge, MHz	Calculated** band edge, MHz	Specified band edge, MHz	Margin***, MHz	Verdict
787.125	QPSK	250	Low	787.0175	787.0166	787.0000	0.0166	Pass
787.125	16QAM	250	Low	787.0175	787.0166	787.0000	0.0166	Pass
787.170	QPSK	330	Low	787.0317	787.0308	787.0000	0.0308	Pass
787.170	16QAM	330	Low	787.0300	787.0291	787.0000	0.0291	Pass
787.875	QPSK	250	High	787.9825	787.9838	788.0000	-0.0162	Pass
787.875	16QAM	250	High	787.9825	787.9838	788.0000	-0.0162	Pass
787.830	QPSK	330	High	787.9675	787.9688	788.0000	-0.0312	Pass
787.830	16QAM	330	High	787.9667	787.9680	788.0000	-0.0320	Pass

* - Measured band edge, MHz – As measured at 26 dBc points
** - Calculated band edge, MHz - Measured band edge, MHz + maximum measured positive / negative drift, MHz
*** - Margin, MHz - Calculated band edge, MHz – Lower / Upper specified band edge, MHz
NOTE: 26 dBc points were measured relative to the total average emission power.

Reference numbers of test equipment used

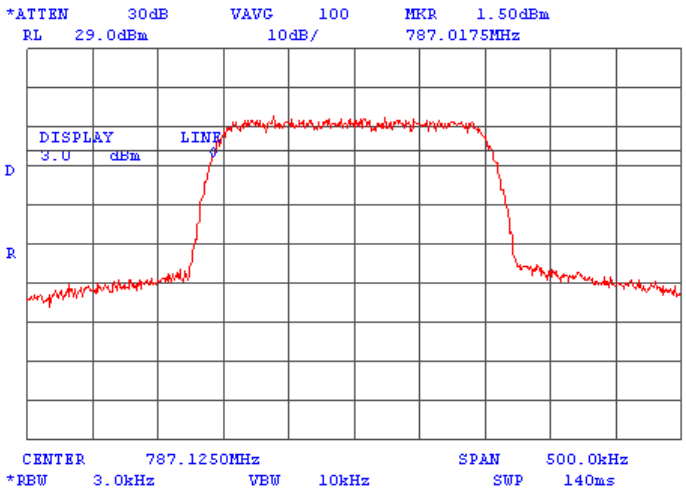
HL 0493	HL 1424	HL 3004					

Full description is given in Appendix A.

Test specification:	Section 27.54, Frequency stability		
Test procedure:	47 CFR, Section 2.1055, TIA/EIA-603-C, Section 2.2.2		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/15/2010 12:04:04 PM		
Temperature: 22.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 51 %	Power Supply: 12 VDC
Remarks:			

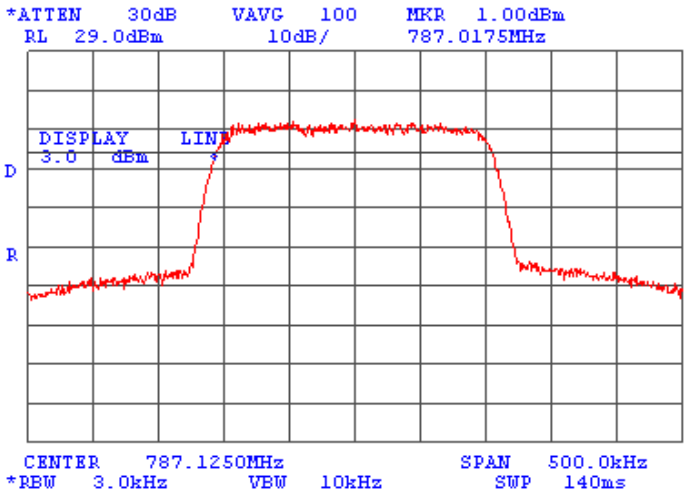
Plot 7.8.1 Band edge emission at low frequency, QPSK

Band edge: Left
Channel Bandwidth: 250 kHz



Plot 7.8.2 Band edge emission at low frequency, 16QAM

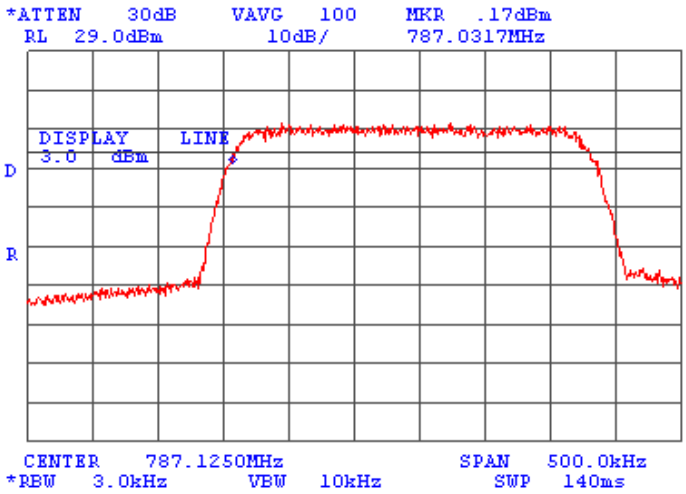
Band edge: Left
Channel Bandwidth: 250 kHz



Test specification:	Section 27.54, Frequency stability		
Test procedure:	47 CFR, Section 2.1055, TIA/EIA-603-C, Section 2.2.2		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/15/2010 12:04:04 PM		
Temperature: 22.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 51 %	Power Supply: 12 VDC
Remarks:			

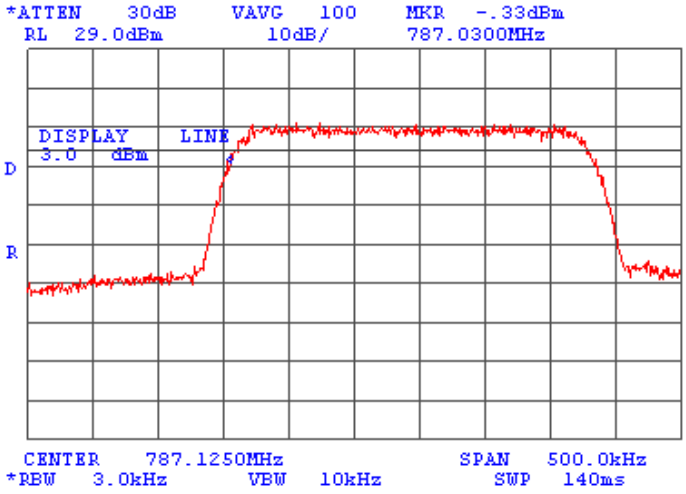
Plot 7.8.3 Band edge emission at low frequency, QPSK

Band edge: Left
Channel Bandwidth: 330 kHz



Plot 7.8.4 Band edge emission at low frequency, 16QAM

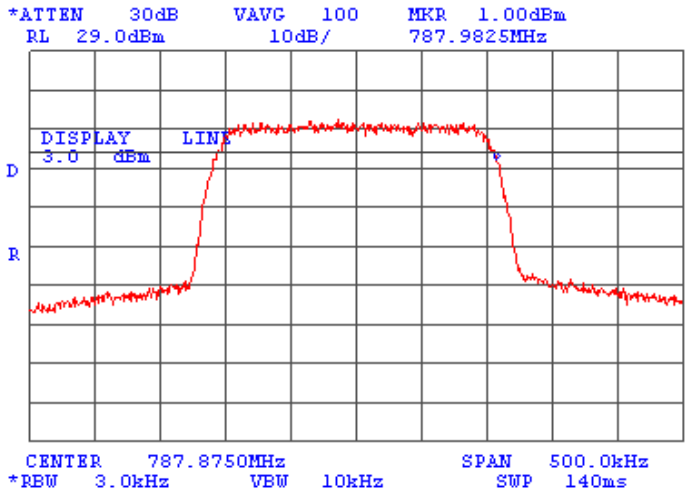
Band edge: Left
Channel Bandwidth: 330 kHz



Test specification:	Section 27.54, Frequency stability		
Test procedure:	47 CFR, Section 2.1055, TIA/EIA-603-C, Section 2.2.2		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/15/2010 12:04:04 PM		
Temperature: 22.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 51 %	Power Supply: 12 VDC
Remarks:			

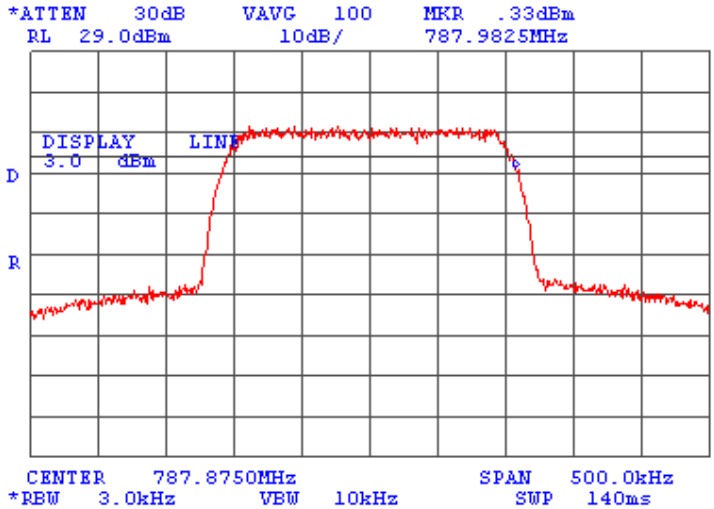
Plot 7.8.5 Band edge emission at high frequency, QPSK

Band edge: Right
Channel Bandwidth: 250 kHz



Plot 7.8.6 Band edge emission at high frequency, 16QAM

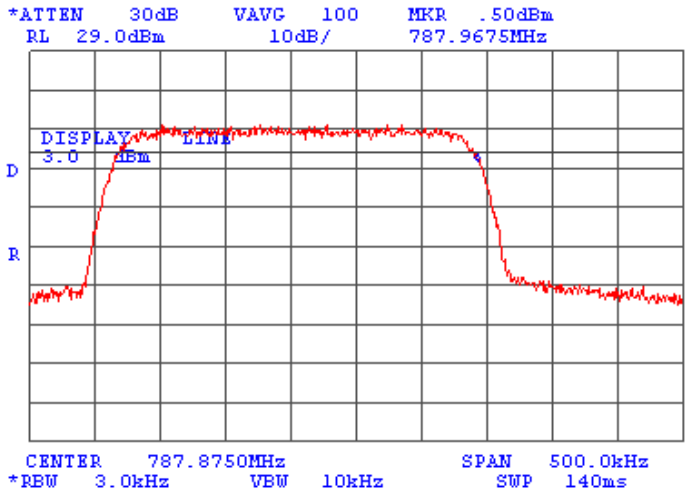
Band edge: Right
Channel Bandwidth: 250 kHz



Test specification:	Section 27.54, Frequency stability		
Test procedure:	47 CFR, Section 2.1055, TIA/EIA-603-C, Section 2.2.2		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/15/2010 12:04:04 PM		
Temperature: 22.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 51 %	Power Supply: 12 VDC
Remarks:			

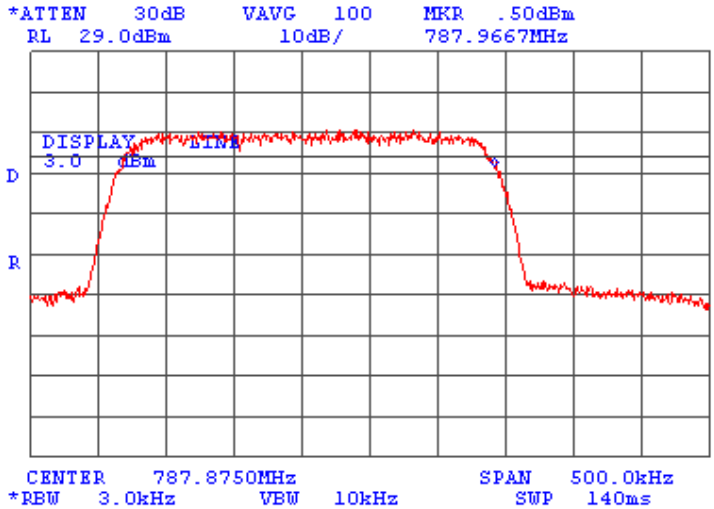
Plot 7.8.7 Band edge emission at high frequency, QPSK

Band edge: Right
Channel Bandwidth: 330 kHz



Plot 7.8.8 Band edge emission at high frequency, 16QAM

Band edge: Right
Channel Bandwidth: 330 kHz



Test specification:	Section 2.1091, RF radiation exposure evaluation		
Test procedure:	47 CFR, Section 1.1307(b)1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/15/2010 12:04:17 PM		
Temperature: 22.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 51 %	Power Supply: 12 VDC
Remarks:			

7.9 RF exposure

7.9.1 General

This test was performed to determine the minimum safe distance between the transmitter antenna and human to avoid public exposure in excess of limits for general population (uncontrolled exposure). Specification test limits are given in Table 7.9.1.

Table 7.9.1 RF exposure limits

Frequency range, MHz	Power density*	
	mW/cm^2	W/m^2
787.0 – 788.0	0.52 – 0.53	5.2 – 5.3

*- Power density limit within 300 - 1500 MHz was calculated according to the following equation: S = F / 1500, where S is power density in mW/cm^2 and F is frequency in MHz.

7.9.2 Safe distance calculation for fixed transmitter

The minimum safe distance was calculated from the following equation as provided in Table 7.9.2:

$$r = sqrt[P \times G / (4 \times \pi \times S)],$$

where S is power density in W/m^2 , P is the transmitter output power in W, G is the transmitter antenna numeric gain and r is distance to transmit antenna in m.
With power density equal to the RF exposure limit the minimum safe distance was calculated according to the following equation: $r = sqrt[P \times G / (4 \times \pi \times S])$

Table 7.9.2 Safe distance calculation

ASSIGNED FREQUENCY: 902.0 – 928.0 MHz
EQUIPMENT INTENDED USE: Fixed*

Carrier frequency, MHz	Peak output power, dBm	Antenna gain, dB	EIRP		Power density limit, W/m^2	Safe distance m**	Intended separation m	Verdict
			dBm	W				
787.375	29.05	14.0	43.05	20.18	5.25	0.517392	2.0	Pass

- - The equipment deemed fixed as intended for use at a distance of more than 2.0 m from humans.

8 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
0446	Antenna, Loop, Active, 10 kHz - 30 MHz	EMCO	6502	2857	29-Jun-09	29-Jun-10
0493	Temperature Chamber -45…175 deg C	Thermotron	S-1.2 Mini-Max	14016	20-May-09	20-May-10
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	27-Aug-09	27-Aug-10
0557	Generator Signal, 9 KHz - 1.2 GHz	Marconi Instruments	2023	112225/08 0	16-Feb-10	16-Feb-11
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	11-Jan-10	11-Jan-11
1424	Spectrum Analyzer, 30 Hz- 40 GHz	Agilent Technologies	8564EC	3946A002 19	28-Aug-09	28-Aug-10
1984	Antenna, Double-Ridged Waveguide Horn, 1-18 GHz, 300 W	EMC Test Systems	3115	9911-5964	29-Jan-10	29-Jan-11
2951	Cable, RF, 18 GHz, 0.9 m, SMA-SMA	Gore	10020014	NA	05-Oct-09	05-Oct-10
3004	Analyzer, Spectrum, 9.0 kHz - 2.2 GHz	Anritsu	MS2601A	MT09861	27-Mar-09	27-Mar-10
3042	Antenna, Horn, 1-18 GHz	Hermon Laboratories	A1-18	3042	29-Jan-10	29-Jan-11
3121	Microwave Cable Assembly, 18 GHz, 6.4 m, SMA - SMA	Huber-Suhner	198-9155-00	3121	01-Jan-10	01-Jan-10
3123	Microwave Cable Assembly, 18 GHz, 6.4 m, SMA - SMA	Huber-Suhner	198-9155-00	3123	01-Jan-10	01-Jan-10
3301	Power Meter, P-series, 50 MHz to 40 GHz	Agilent Technologies	N1911A	MY451010 57	14-Dec-09	14-Dec-10
3302	Power sensor, P-Series, 50 MHz to 40 GHz, -35/30 to 20 dBm	Agilent Technologies	N1922A	MY452405 86	14-Dec-09	14-Dec-10
3341	High Pass Filter, 50 Ohm, 1400 to 5000 MHz.	Mini-Circuits	VHF-1300+	NA	05-Oct-09	05-Oct-10
3386	Microwave Cable Assembly, 26.5 GHz, 1.0 m, N type/N type	Suhner Sucoflex	104EA	3386	25-Feb-10	25-Feb-11
3441	Precision Fixed Attenuator, 50 Ohm, 5 W, 20 dB, DC to 18 GHz	Mini-Circuits	BW-S20W5+	NA	01-Jan-10	01-Jan-10
3442	Precision Fixed Attenuator, 50 Ohm, 5 W, 20 dB, DC to 18 GHz	Mini-Circuits	BW-S20W5+	NA	07-Mar-10	07-Mar-11
3443	Wrist Strap Tester	Motyknit Technologies	WSC 0101	03466	15-Jan-09	15-Aug-10
3616	Cable RF, 6.5 m, N type-N type, DC-6.5 GHz	Suhner Switzerland	Rg 214/U	NA	02-Dec-09	02-Dec-10
3762	Precision Fixed Attenuator, 50 Ohm, 5 W, 20 dB, DC to 18 GHz	Mini-Circuits	BW-S20W5+	NA	07-Dec-09	07-Dec-10
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY482502 88	25-Sep-09	25-Sep-10
3884	Preamplifier, 0.1 to 18 GHz, Gain 25 dB, N-type(f) in, N-type(m) out.	Agilent Technologies	87405C	MY470104 18	13-Jan-10	13-Jan-11

9 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Transmitter tests	
Carrier power conducted at antenna connector	± 1.7 dB
Carrier power radiated (substitution method)	± 4.5 dB
Occupied bandwidth	±8%
Conducted emissions at RF antenna connector	9 kHz to 2.9 GHz: ± 2.6 dB 2.9 GHz to 6.46 GHz: ± 3.5 dB 6.46 GHz to 13.2 GHz: ± 4.3 dB 13.2 GHz to 22.0 GHz: ± 5.0 dB 22.0 GHz to 26.8 GHz: ± 5.5 dB 26.8 GHz to 40.0 GHz: ± 4.8 dB
Spurious emissions radiated 30 MHz – 40 GHz (substitution method)	± 4.5 dB
Frequency error	30 – 300 MHz: ± 50.5 Hz (1.68 ppm) 300 – 1000 MHz: ± 168 Hz (0.56 ppm)
Transient frequency behaviour	187 Hz ± 13.9 %
Duty cycle, timing (Tx ON / OFF) and average factor measurements	± 1.0 %

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).

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Person for contact: Mr. Alex Usoskin, CEO.

11 APPENDIX D Specification references

47CFR part 27: 2009	Miscellaneous wireless communications services
FCC 47CFR part 1: 2009	Practice and procedure
FCC 47CFR part 2: 2009	Frequency allocations and radio treaty matters; general rules and regulations
ANSI C63.2: 1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
ANSI C63.4: 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.
ANSI/TIA/EIA-603-C:2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards

12 APPENDIX E Test equipment correction factors

Antenna Factor
Active Loop Antenna
EMC Test Systems, model 6502, S/N 2857, HL 0446

Frequency, MHz	Magnetic Antenna Factor, dB(S/m)	Electric Antenna Factor, dB(1/m)
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	9.7
0.750	-41.9	9.6
1.000	-41.4	10.1
2.000	-41.5	10.0
3.000	-41.4	10.1
4.000	-41.4	10.1
5.000	-41.5	10.0
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(S/m) is to be added to receiver meter reading in dB(μV) to convert it into field intensity in dB(μA/m).
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)
26	7.8	940	24.0
28	7.8	960	24.1
30	7.8	980	24.5
40	7.2	1000	24.9
60	7.1	1020	25.0
70	8.5	1040	25.2
80	9.4	1060	25.4
90	9.8	1080	25.6
100	9.7	1100	25.7
110	9.3	1120	26.0
120	8.8	1140	26.4
130	8.7	1160	27.0
140	9.2	1180	27.0
150	9.8	1200	26.7
160	10.2	1220	26.5
170	10.4	1240	26.5
180	10.4	1260	26.5
190	10.3	1280	26.6
200	10.6	1300	27.0
220	11.6	1320	27.8
240	12.4	1340	28.3
260	12.8	1360	28.2
280	13.7	1380	27.9
300	14.7	1400	27.9
320	15.2	1420	27.9
340	15.4	1440	27.8
360	16.1	1460	27.8
380	16.4	1480	28.0
400	16.6	1500	28.5
420	16.7	1520	28.9
440	17.0	1540	29.6
460	17.7	1560	29.8
480	18.1	1580	29.6
500	18.5	1600	29.5
520	19.1	1620	29.3
540	19.5	1640	29.2
560	19.8	1660	29.4
580	20.6	1680	29.6
600	21.3	1700	29.8
620	21.5	1720	30.3
640	21.2	1740	30.8
660	21.4	1760	31.1
680	21.9	1780	31.0
700	22.2	1800	30.9
720	22.2	1820	30.7
740	22.1	1840	30.6
760	22.3	1860	30.6
780	22.6	1880	30.6
800	22.7	1900	30.6
820	22.9	1920	30.7
840	23.1	1940	30.9
860	23.4	1960	31.2
880	23.8	1980	31.6
900	24.1	2000	32.0
920	24.1		

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

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

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

Cable loss
Cable coaxial, Gore, 18 GHz, 0.9 m, SMA-SMA, S/N 10020014
HL 2951

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.07	5750	0.77	12000	1.23
30	0.06	6000	0.78	12250	1.25
100	0.09	6250	0.81	12500	1.26
250	0.15	6500	0.83	12750	1.26
500	0.21	6750	0.84	13000	1.30
750	0.27	7000	0.85	13250	1.30
1000	0.31	7250	0.88	13500	1.30
1250	0.36	7500	0.88	13750	1.29
1500	0.38	7750	0.93	14000	1.23
1750	0.42	8000	0.92	14250	1.32
2000	0.44	8250	0.94	14500	1.27
2250	0.47	8500	0.99	14750	1.27
2500	0.50	8750	0.97	15000	1.34
2750	0.52	9000	1.01	15250	1.36
3000	0.54	9250	1.05	15500	1.35
3250	0.57	9500	1.08	15750	1.36
3500	0.58	9750	1.10	16000	1.43
3750	0.61	10000	1.09	16250	1.38
4000	0.63	10250	1.09	16500	1.42
4250	0.66	10500	1.07	16750	1.49
4500	0.68	10750	1.10	17000	1.53
4750	0.70	11000	1.09	17250	1.59
5000	0.71	11250	1.09	17500	1.65
5250	0.74	11500	1.13	17750	1.82
5500	0.77	11750	1.12	18000	2.09

Cable loss
Microwave Cable Assembly, 18 GHz, 6.4 m, SMA – SMA, Huber-Suhner, model 198-9155-00
HL 3121

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.08	3600	2.10	7400	3.08	11200	3.85	15100	4.58
30	0.18	3700	2.14	7500	3.11	11300	3.85	15200	4.60
50	0.26	3800	2.18	7600	3.14	11400	3.86	15300	4.63
100	0.34	3900	2.19	7700	3.16	11500	3.86	15400	4.65
200	0.47	4000	2.25	7800	3.18	11600	3.87	15500	4.71
300	0.59	4100	2.25	7900	3.20	11700	3.85	15600	4.70
400	0.66	4200	2.28	8000	3.22	11800	3.96	15700	4.69
500	0.75	4300	2.35	8100	3.26	11900	3.92	15800	4.71
600	0.83	4400	2.35	8200	3.27	12000	3.92	15900	4.74
700	0.90	4500	2.38	8300	3.29	12100	3.94	16000	4.69
800	0.96	4600	2.43	8400	3.30	12200	3.94	16100	4.72
900	1.02	4700	2.43	8500	3.31	12300	3.99	16200	4.71
1000	1.07	4800	2.45	8600	3.33	12400	4.02	16300	4.74
1100	1.12	4900	2.48	8700	3.35	12500	4.10	16400	4.74
1200	1.15	5000	2.55	8800	3.36	12600	4.09	16500	4.75
1300	1.22	5100	2.54	8900	3.38	12700	4.15	16600	4.78
1400	1.28	5200	2.56	9000	3.40	12800	4.15	16700	4.86
1500	1.29	5300	2.58	9100	3.41	12900	4.08	16800	4.84
1600	1.36	5400	2.61	9200	3.45	13000	4.21	16900	4.83
1700	1.40	5500	2.64	9300	3.48	13100	4.19	17000	4.86
1800	1.45	5600	2.69	9400	3.52	13200	4.29	17100	4.83
1900	1.51	5700	2.67	9500	3.54	13300	4.24	17200	4.90
2000	1.50	5800	2.71	9600	3.59	13400	4.26	17300	4.91
2100	1.56	5900	2.73	9700	3.59	13500	4.26	17400	4.94
2200	1.59	6000	2.75	9800	3.62	13600	4.29	17500	4.93
2300	1.63	6100	2.81	9900	3.70	13700	4.35	17600	4.93
2400	1.73	6200	2.80	10000	3.70	13800	4.31	17700	5.00
2500	1.73	6300	2.82	10100	3.72	13900	4.29	17800	5.01
2600	1.78	6400	2.85	10200	3.73	14000	4.32	17900	5.00
2700	1.84	6500	2.87	10300	3.75	14100	4.33	18000	5.00
2800	1.84	6600	2.90	10400	3.76	14200	4.34		
2900	1.91	6700	2.91	10500	3.77	14300	4.36		
3000	1.91	6800	2.94	10600	3.79	14400	4.38		
3100	1.97	6900	2.96	10700	3.80	14600	4.42		
3200	1.98	7000	2.98	10800	3.81	14700	4.42		
3300	2.04	7100	3.01	10900	3.81	14800	4.55		
3400	2.04	7200	3.02	11000	3.83	14900	4.55		
3500	2.10	7300	3.04	11100	3.84	15000	4.55		

Cable loss
Microwave Cable Assembly, 18 GHz, 6.4 m, SMA – SMA, Huber-Suhner, model 198-9155-00
HL 3123

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.11	3600	1.97	7400	3.12	11200	3.90	15100	4.74
30	0.17	3700	1.97	7500	3.13	11300	3.93	15200	4.70
50	0.25	3800	2.03	7600	3.16	11400	3.88	15300	4.73
100	0.32	3900	2.04	7700	3.18	11500	3.87	15400	4.78
200	0.46	4000	2.10	7800	3.20	11600	3.90	15500	4.75
300	0.58	4100	1.97	7900	3.23	11700	3.86	15600	4.76
400	0.65	4200	1.97	8000	3.25	11800	3.88	15700	4.75
500	0.74	4300	2.03	8100	3.26	11900	3.86	15800	4.78
600	0.82	4400	2.04	8200	3.28	12000	3.89	15900	4.79
700	0.89	4500	2.10	8300	3.31	12100	3.94	16000	4.73
800	0.95	4600	1.97	8400	3.31	12200	3.92	16100	4.78
900	1.01	4700	1.97	8500	3.32	12300	3.96	16200	4.84
1000	1.07	4800	2.03	8600	3.34	12400	4.01	16300	4.90
1100	1.11	4900	2.04	8700	3.35	12500	4.07	16400	4.87
1200	1.17	5000	2.10	8800	3.37	12600	4.08	16500	4.90
1300	1.22	5100	2.53	8900	3.39	12700	4.17	16600	4.98
1400	1.27	5200	2.55	9000	3.42	12800	4.26	16700	5.05
1500	1.29	5300	2.60	9100	3.43	12900	4.16	16800	5.04
1600	1.35	5400	2.61	9200	3.51	13000	4.21	16900	5.02
1700	1.40	5500	2.64	9300	3.52	13100	4.24	17000	5.09
1800	1.44	5600	2.70	9400	3.54	13200	4.27	17100	5.07
1900	1.51	5700	2.67	9500	3.63	13300	4.31	17200	5.10
2000	1.49	5800	2.71	9600	3.61	13400	4.33	17300	5.13
2100	1.55	5900	2.74	9700	3.71	13500	4.25	17400	5.23
2200	1.58	6000	2.80	9800	3.66	13600	4.27	17500	5.21
2300	1.62	6100	2.79	9900	3.77	13700	4.33	17600	5.22
2400	1.72	6200	2.81	10000	3.75	13800	4.33	17700	5.36
2500	1.76	6300	2.83	10100	3.77	13900	4.31	17800	5.35
2600	1.78	6400	2.86	10200	3.80	14000	4.30	17900	5.45
2700	1.80	6500	2.88	10300	3.79	14100	4.30	18000	5.43
2800	1.86	6600	2.90	10400	3.87	14200	4.31		
2900	1.90	6700	2.92	10500	3.83	14300	4.37		
3000	1.90	6800	2.98	10600	3.88	14400	4.35		
3100	1.97	6900	2.98	10700	3.86	14600	4.53		
3200	1.97	7000	3.00	10800	3.87	14700	4.50		
3300	2.03	7100	3.02	10900	3.90	14800	4.62		
3400	2.04	7200	3.04	11000	3.84	14900	4.65		
3500	2.10	7300	3.06	11100	3.88	15000	4.79		

Cable loss
Cable coaxial, Microwave Cable Assembly, 104EA, 18 GHz, 1.0 m
Suhner Sucoflex, HL 3386

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.05	5750	1.01	12000	1.29
30	0.07	6000	1.02	12250	1.33
100	0.12	6250	1.02	12500	1.36
250	0.18	6500	0.95	12750	1.35
500	0.26	6750	0.96	13000	1.36
750	0.32	7000	1.01	13250	1.39
1000	0.35	7250	1.04	13500	1.37
1250	0.41	7500	1.09	13750	1.43
1500	0.45	7750	1.12	14000	1.46
1750	0.50	8000	1.13	14250	1.39
2000	0.54	8250	1.15	14500	1.36
2250	0.57	8500	1.15	14750	1.47
2500	0.61	8750	1.15	15000	1.47
2750	0.64	9000	1.16	15250	1.41
3000	0.67	9250	1.14	15500	1.52
3250	0.70	9500	1.14	15750	1.54
3500	0.71	9750	1.19	16000	1.49
3750	0.74	10000	1.20	16250	1.48
4000	0.77	10250	1.22	16500	1.52
4250	0.80	10500	1.23	16750	1.56
4500	0.84	10750	1.22	17000	1.57
4750	0.85	11000	1.21	17250	1.53
5000	0.84	11250	1.24	17500	1.55
5250	0.85	11500	1.26	17750	1.55
5500	0.92	11750	1.28	18000	1.54

Cable loss
Cable coaxial, RG-214/U, N type-N type, 6.5 m
Suhner Switzerland, HL 3616

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.13	1750	2.66	3550	4.44	5350	6.08
30	0.25	1800	2.72	3600	4.46	5400	6.12
50	0.32	1850	2.78	3650	4.59	5450	6.17
100	0.48	1900	2.81	3700	4.60	5500	6.25
150	0.60	1950	2.86	3750	4.72	5550	6.31
200	0.71	2000	2.94	3800	4.72	5600	6.35
250	0.81	2050	2.97	3850	4.86	5650	6.41
300	0.91	2100	3.01	3900	4.85	5700	6.50
350	1.00	2150	3.06	3950	4.99	5750	6.52
400	1.07	2200	3.11	4000	4.90	5800	6.57
450	1.14	2250	3.16	4050	5.04	5850	6.61
500	1.23	2300	3.21	4100	5.01	5900	6.71
550	1.30	2350	3.26	4150	5.10	5950	6.70
600	1.37	2400	3.31	4200	5.08	6000	6.75
650	1.44	2450	3.35	4250	5.18	6050	6.74
700	1.50	2500	3.39	4300	5.14	6100	6.84
750	1.58	2550	3.46	4350	5.22	6150	6.87
800	1.64	2600	3.48	4400	5.21	6200	6.93
850	1.69	2650	3.55	4450	5.29	6250	6.96
900	1.77	2700	3.59	4500	5.31	6300	7.02
950	1.79	2750	3.66	4550	5.39	6350	7.04
1000	1.87	2800	3.68	4600	5.41	6400	7.10
1050	1.92	2850	3.75	4650	5.49	6450	7.11
1100	1.98	2900	3.79	4700	5.52	6500	7.19
1150	2.05	2950	3.86	4750	5.60		
1200	2.09	3000	3.89	4800	5.64		
1250	2.15	3050	3.94	4850	5.73		
1300	2.21	3100	3.98	4900	5.70		
1350	2.27	3150	4.03	4950	5.73		
1400	2.33	3200	4.06	5000	5.75		
1450	2.38	3250	4.12	5050	5.83		
1500	2.44	3300	4.14	5100	5.82		
1550	2.48	3350	4.22	5150	5.91		
1600	2.52	3400	4.24	5200	5.92		
1650	2.56	3450	4.31	5250	5.98		
1700	2.62	3500	4.35	5300	6.01		

13 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
A/m	ampere per meter
AM	amplitude modulation
AVRG	average (detector)
BB	broadband
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
dBΩ	decibel referred to one Ohm
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
ITE	information technology equipment
k	kilo
kHz	kilohertz
LO	local oscillator
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
μs	microsecond
NA	not applicable
NB	narrowband
OATS	open area test site
Ω	Ohm
QP	quasi-peak
PCB	printed circuit board
PM	pulse modulation
PS	power supply
RE	radiated emission
RF	radio frequency
rms	root mean square
Rx	receive
s	second
T	temperature
Tx	transmit
V	volt
VA	volt-ampere

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