HERMON LABORATORIES

ELECTRICAL TESTING
0839.01

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TEST REPORT

ACCORDING TO: FCC 47CFR part 27

FOR:

Airspan Networks Inc.
LTE Base Station
Model: AirHarmony 4400, 2.5GHz (B41)
FCC ID:PIDH4K425

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1 Applicant information

Client name:	Airspan Networks Inc.
Address:	777 Yamato, Road Suite 310 Boca Raton, FL 33431, USA
Telephone:	+1 561 893 8670
Fax:	+1 561 893 8671
E-mail:	zlevi@airspan.com
Contact name:	Mr. Zion Levi

2 Equipment under test attributes

Product name:	LTE Base Station
Product type:	Transceiver
Model(s):	AirHarmony 4400, 2.5 GHz (B41)
Serial number:	D3EF0BCE3180
Hardware version:	B3
Software release:	14_15_20_071
Receipt date	27-Feb-17

3 Manufacturer information

Manufacturer name:	Airspan Networks Inc.
Address:	777 Yamato, Road Suite 310 Boca Raton, FL 33431, USA
Telephone:	+1 561 893 8670
Fax:	+1 561 893 8671
E-Mail:	zlevi@airspan.com
Contact name:	Mr. Zion Levi

4 Test details

Project ID:	29264
Location:	Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started:	20-Feb-17
Test completed:	22-Mar-17
Test specification(s):	FCC 47CFR part 27

5 Tests summary

Test	Status
Transmitter characteristics	
Section 27.50(h), Peak output power at RF antenna connector	Pass
Section 27.50(h)(4), Spectral power density	Pass
Section 27.53(m)(2), Band edge emissions at RF antenna connector	Pass
Section 2.1049, Occupied bandwidth	Pass

The product was approved under FCC ID:PIDH4K425 for operation in 3 bands: 2498.5 – 2687.5 MHz, 2620.5 – 2687.5 MHz, 2498.5 – 2565.5 MHz with 5 MHz, 10 MHz and 20 MHz channel bandwidth.
The relevant tests to support 40 MHz channel bandwidth and submit Application for Class II permissive changes certification were done.
The bandwidth change is software controlled, no hardware change was made.

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.

This test report supersedes the previously issued test report identified by Doc ID:AIRRAD_FCC.29264.

	Name and Title	Date	Signature
Tested by:	Mr. S. Samokha, test engineer	February 22, 2017	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	March 6, 2017	
Approved by:	Mr. M. Nikishin, EMC and radio group leader	March 22, 2017	

6 EUT description

6.1 General information

The EUT, Base station radio, AirHarmony 4400 2.5GHz (B41), is part of a LTE broadband fixed cellular wireless access system. The system provides a radio link between an end-user (a subscriber) and a network to give high-speed data access. The AirHarmony's transceiver/receiver (Up to 64 QAM modulation, data rate up to 190 Mbps) uses OFDM and operating in TDD mode, equipped with 18 dBi external antenna. Advanced Antenna Techniques 2x4 MIMO are supported (the detailed description provided in the Operational description exhibit in Application for certification). The maximum total RF output power (not including antenna gain) is 46.2 dBm for 18 dBi antenna and it can be reduced by software.
The AirHarmony is installed outdoors and typically is mounted on a pole. The Subscriber transmits and receives traffic to and from the base station respectively. The transceiver provides subscribers with "always-on" Internet, high speed data only, or data and voice (VoIP) services and is configured with a unique base station reference number, preventing the LTE UE from relocating to another subscriber premises without authorization.
The EUT, AirHarmony 4400 2.5GHz (B41), comes in range of three frequency band variants that can be installed with different external Cavity filters. Frequency bands are 2496 – 2690 MHz, 2618 – 2690 MHz and 2496 – 2568 MHz. The external Cavity filters are designed specifically for AirHarmony 4400 deployments. The installation and replacement of the external filters can be performed by licensed installer only according installation procedure.

6.2 Ports and lines

Port Type	Port description	Connected from	Connected to	Qty.	Cable type	Cable length, m
Power	AC power	EUT	AC mains	1	Unshielded	3
Signal	GPS	EUT	GPS external antenna	1	Coax	3
Signal	Eth. POE	EUT	Laptop	1	FTP	3
Signal	Eth. POE	EUT	Open circuit	1	FTP	3
Signal	Eth.	EUT	Open circuit	2	FTP	3
RF	RF Link (Tx/Rx)	EUT	Antenna (via filter)	4	Coax	1
Signal*	Serial*	Not connected	Not connected	1	NA	NA

*for maintenance only

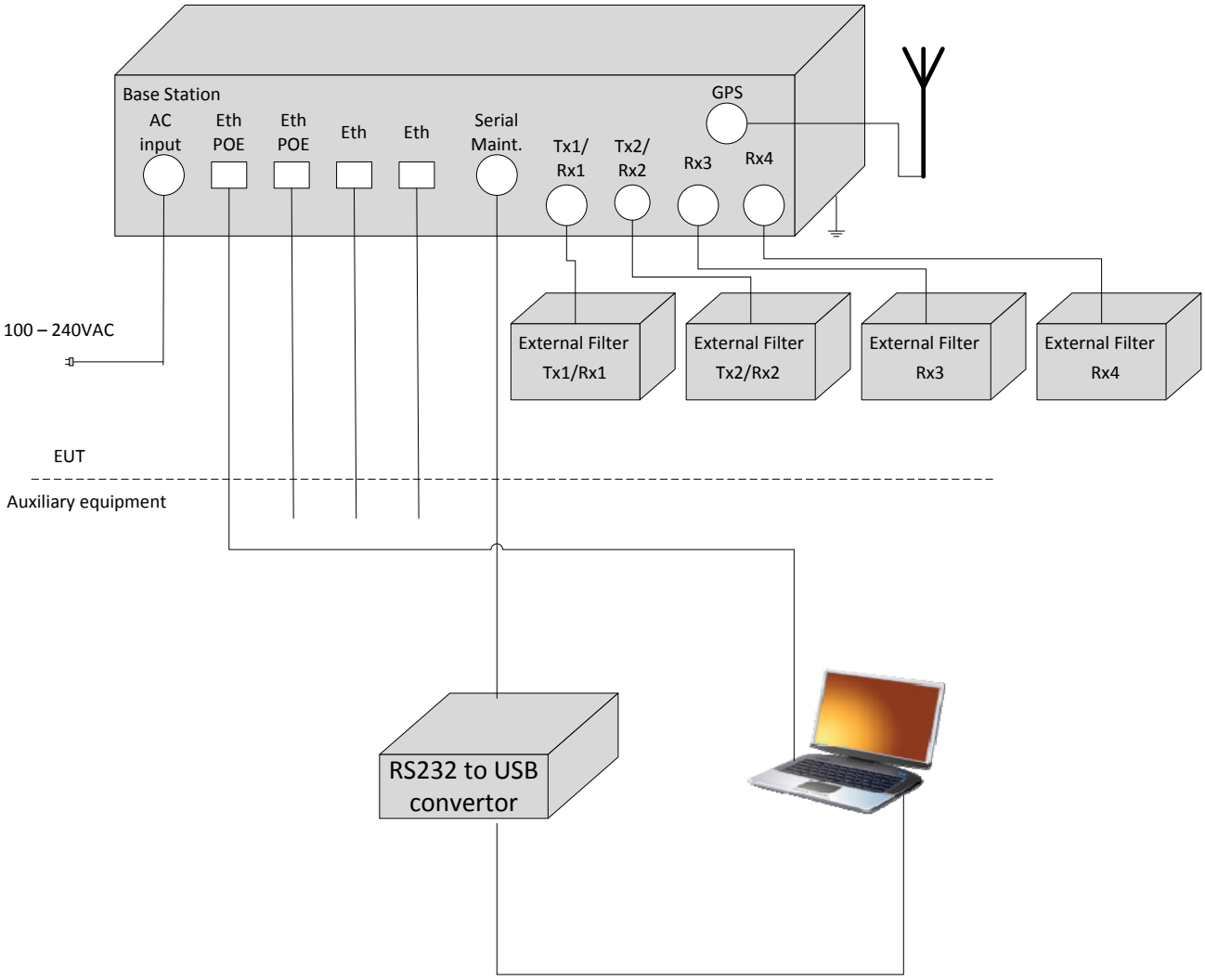
6.3 Support and test equipment

Description	Manufacturer	Model number	Serial number
Laptop	Dell	E7450	8TYRP32

6.4 Changes made in the EUT

No changes were implemented in the EUT during testing.

6.5 Test configuration



6.6 Transmitter characteristics

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

Intended use		**Condition of use**
V	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	2496.0 – 2690.0 MHz (full band)				
Operating frequency (full bands)	2516.0 – 2670.0 MHz for 40 MHz OBW				
RF channel spacing	40 MHz				
Maximum rated output power	At transmitter 50 Ω RF output connector (aggregate power of both RF chains)	45.82 dBm			
Is transmitter output power variable?		No			
	V	Yes		continuous variable	
			V	stepped variable with step size	0.25 dB
				minimum RF power	-30 dBm
				maximum RF power at antenna connector	45.82 dBm

Antenna connection					
unique coupling	**V**	standard connector	Integral	**V**	with temporary RF connector
					without temporary RF connector

Antenna/s technical characteristics			
Type	Manufacturer	Model number	Gain
External	ALPHA Wireless Ltd	AW3007	18 dBi
External	ALPHA Wireless Ltd	AW3008	17 dBi
External sector	Cobham Antenna Systems	SA12-2.5-DS/1915	11 dBi

Transmitter aggregate data rate/s, MBps			
Transmitter 26dBc power bandwidth	Type of modulation		
	QPSK	16QAM	64QAM
40 MHz	46.8 MBps	90.8 MBps	190 MBps

Type of multiplexing	TDD				
Modulating test signal (baseband)	PRBS				
Maximum transmitter duty cycle in normal use	75%				

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

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

Test specification:	Section 2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date(s):	20-Feb-17 - 21-Feb-17		
Temperature: 23.2 ºC	Relative Humidity: 48 %	Air Pressure: 1019 hPa	Power: 120 VAC
Remarks: Operation in full band 2498.5-2687.5 MHz			

7 Transmitter tests according to 47CFR part 27

7.1 Occupied bandwidth test in 2498.5-2687.5 MHz band

7.1.1 General

This test was performed to measure transmitter occupied bandwidth. Specification test limits are given in Table 7.1.1.

Table 7.1.1 Occupied bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, %	Maximum allowed bandwidth, kHz
2496.0 – 2690.0 MHz	99%	NA

* - Modulation envelope reference points are provided in terms of attenuation below the unmodulated carrier.

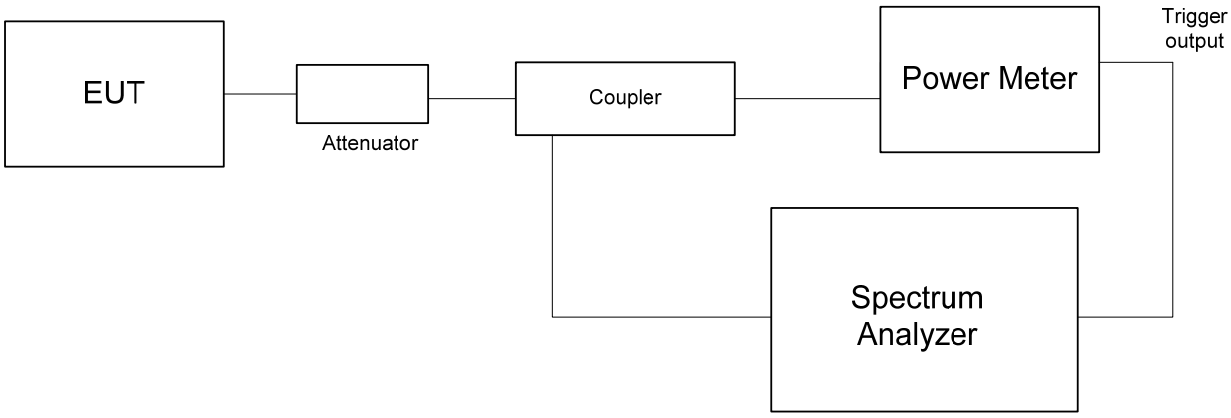
7.1.2 Test procedure

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

7.1.2.2 The EUT was set to transmit the normal modulated signal and actual channel width was measured at the 26 dBc modulation envelope reference points.

7.1.2.3 The transmitter occupied bandwidth was measured with spectrum analyzer as a frequency delta between the reference points on modulation envelope and provided in Table 7.1.2 and the associated plots.

Figure 7.1.1 Occupied bandwidth test setup



Test specification:	**Section 2.1049, Occupied bandwidth**		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	20-Feb-17 - 21-Feb-17		
Temperature: 23.2 ºC	**Relative Humidity:** 48 %	**Air Pressure:** 1019 hPa	**Power:** 120 VAC
Remarks: Operation in full band 2498.5-2687.5 MHz			

Table 7.1.2 Occupied bandwidth test results

DETECTOR USED: Peak
RESOLUTION BANDWIDTH: ≥390 kHz
MODULATION ENVELOPE REFERENCE POINTS: 99%
EBW: 40 MHz

Carrier frequency, MHz	OBW 26 dBc, MHz	OBW 99%. MHz	Limit, kHz	Verdict
QPSK				
2516.0	39.965	37.412	NA	Pass
2594.0	39.796	37.434	NA	Pass
2670.0	39.812	37.428	NA	Pass
64QAM				
2516.0	39.975	37.428	NA	Pass
2594.0	39.998	37.346	NA	Pass
2670.0	39.877	37.339	NA	Pass

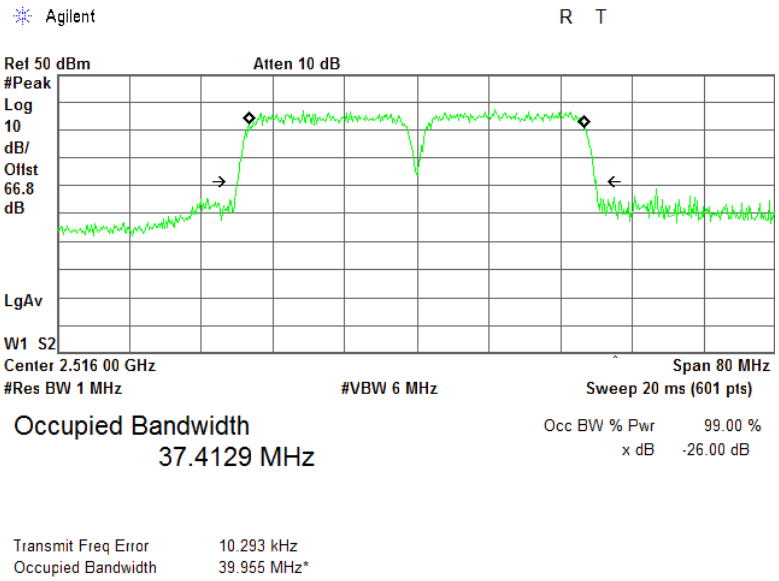
Reference numbers of test equipment used

HL 2214	HL 3301	HL 3302	HL 3818	HL 3901			

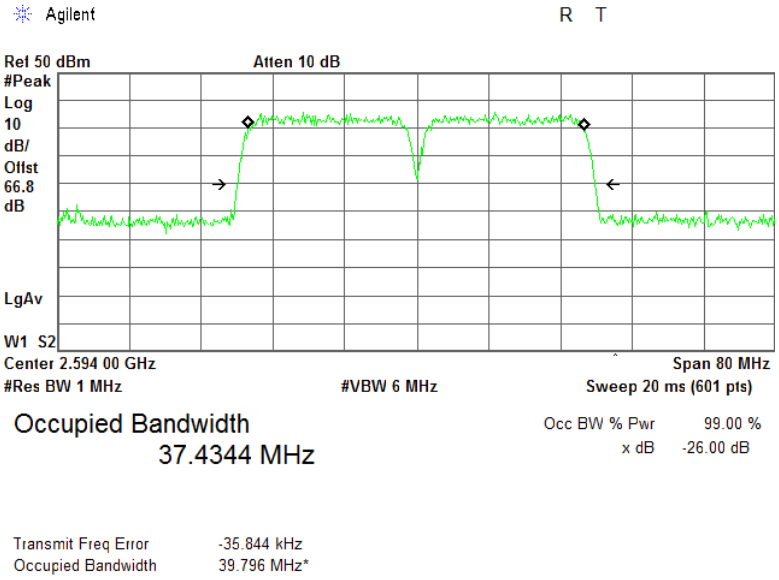
Full description is given in Appendix A.

Test specification:	Section 2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date(s):	20-Feb-17 - 21-Feb-17		
Temperature: 23.2 °C	Relative Humidity: 48 %	Air Pressure: 1019 hPa	Power: 120 VAC
Remarks: Operation in full band 2498.5-2687.5 MHz			

Plot 7.1.1 Occupied bandwidth test results at low frequency, 40 MHz EBW, QPSK

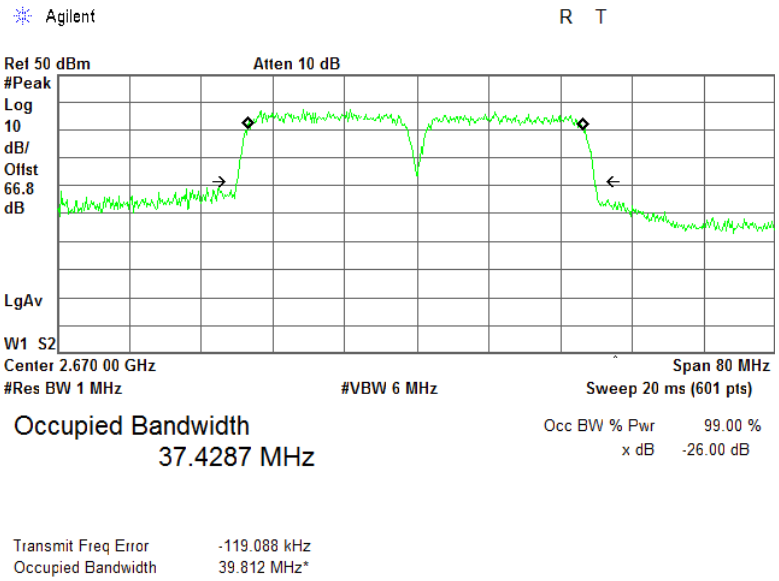


Plot 7.1.2 Occupied bandwidth test results at mid frequency, 40 MHz EBW, QPSK

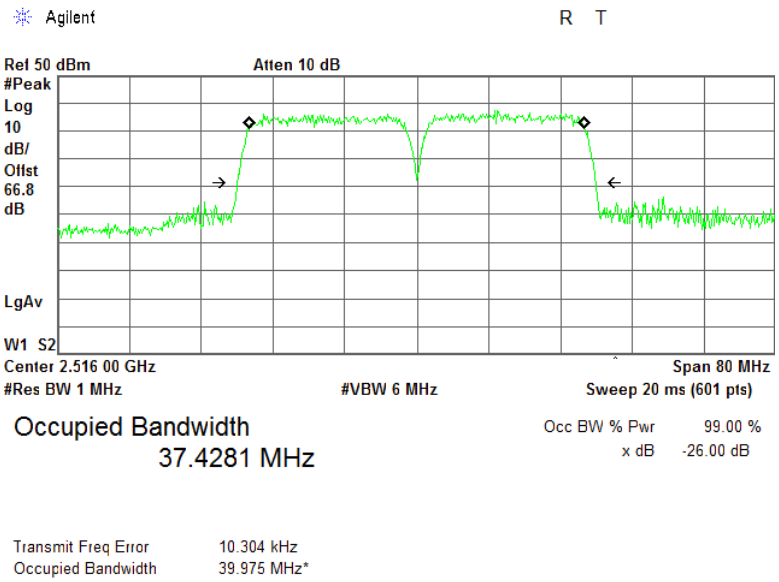


Test specification:	Section 2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date(s):	20-Feb-17 - 21-Feb-17		
Temperature: 23.2 °C	Relative Humidity: 48 %	Air Pressure: 1019 hPa	Power: 120 VAC
Remarks: Operation in full band 2498.5-2687.5 MHz			

Plot 7.1.3 Occupied bandwidth test results at high frequency, 40 MHz EBW, QPSK

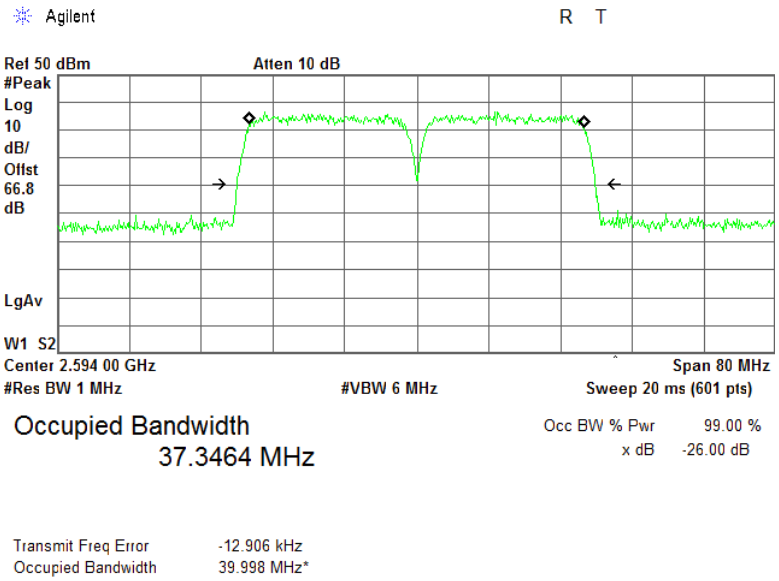


Plot 7.1.4 Occupied bandwidth test results at low frequency, 40 MHz EBW, 64QAM

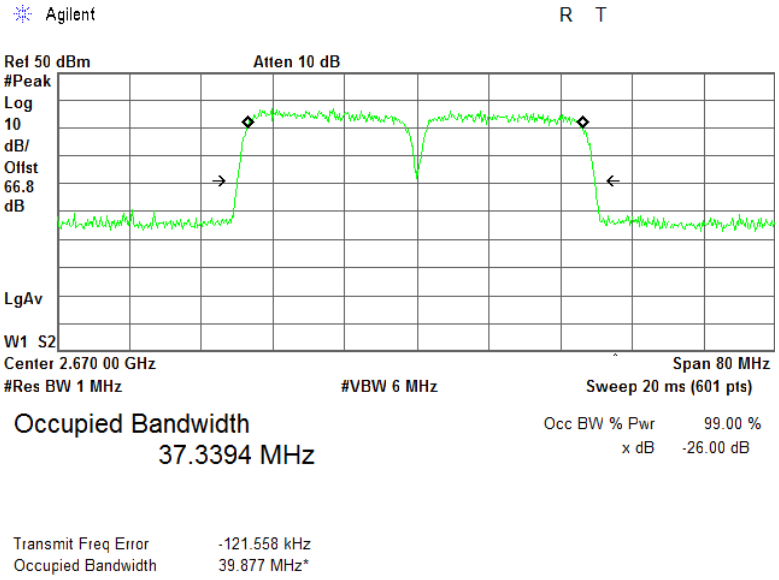


Test specification:	**Section 2.1049, Occupied bandwidth**		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	20-Feb-17 - 21-Feb-17		
Temperature: 23.2 °C	**Relative Humidity:** 48 %	**Air Pressure:** 1019 hPa	**Power:** 120 VAC
Remarks: Operation in full band 2498.5-2687.5 MHz			

Plot 7.1.5 Occupied bandwidth test results at mid frequency, 40 MHz EBW, 64QAM



Plot 7.1.6 Occupied bandwidth test results at high frequency, 40 MHz EBW, 64QAM



Test specification:	Section 2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Mar-17		
Temperature: 23.2 ºC	Relative Humidity: 48 %	Air Pressure: 1019 hPa	Power: 120 VAC
Remarks: Operation in low band 2498.5 – 2565.5 MHz			

7.2 Occupied bandwidth test in 2498.5-2565.5 MHz band

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*, %	Maximum allowed bandwidth, kHz
2496.0 – 2572.0 MHz	99%	NA

* - Modulation envelope reference points are provided in terms of attenuation below the unmodulated carrier.

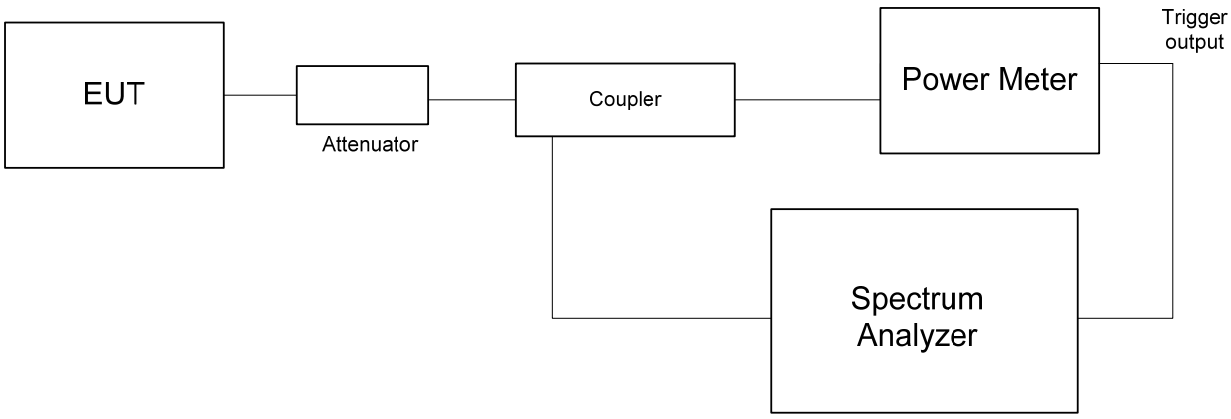
7.2.2 Test procedure

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 normal modulated signal and actual channel width was measured at the 26 dBc modulation envelope reference points.

7.2.2.3 The transmitter occupied bandwidth was measured with spectrum analyzer as a frequency delta between the reference points on modulation envelope and 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(s):	21-Mar-17		
Temperature: 23.2 ºC	**Relative Humidity:** 48 %	**Air Pressure:** 1019 hPa	**Power:** 120 VAC
Remarks: Operation in low band 2498.5 – 2565.5 MHz			

Table 7.2.2 Occupied bandwidth test results

DETECTOR USED: Peak
RESOLUTION BANDWIDTH: ≥390 kHz
MODULATION ENVELOPE REFERENCE POINTS: 99%
EBW: 40 MHz

Carrier frequency, MHz	OBW 26 dBc, MHz	OBW 99%. MHz	Limit, kHz	Verdict
QPSK				
2516.0	39.786	37.396	NA	Pass
2537.0	39.777	37.407	NA	Pass
2548.0	39.860	37.380	NA	Pass
64QAM				
2516.0	39.975	37.428	NA	Pass
2537.0	38.625	37.271	NA	Pass
2548.0	39.654	37.381	NA	Pass

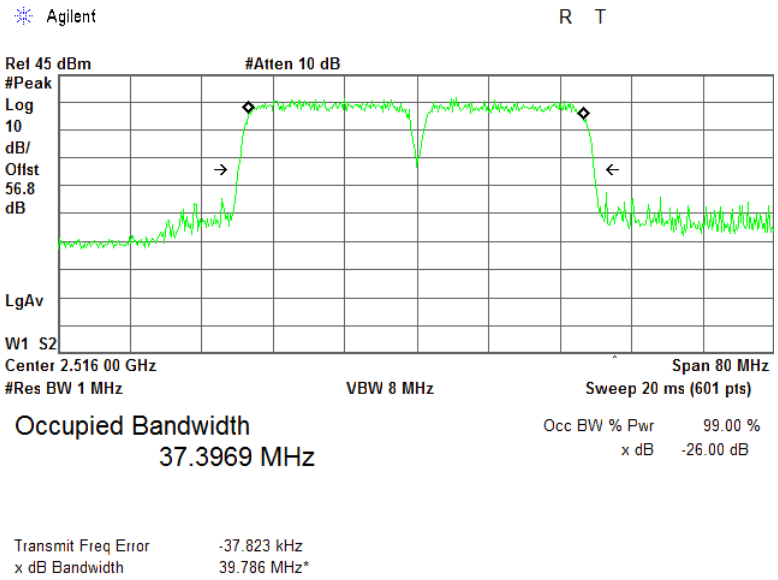
Reference numbers of test equipment used

HL 2214	HL 3301	HL 3302	HL 3818	HL 3901			

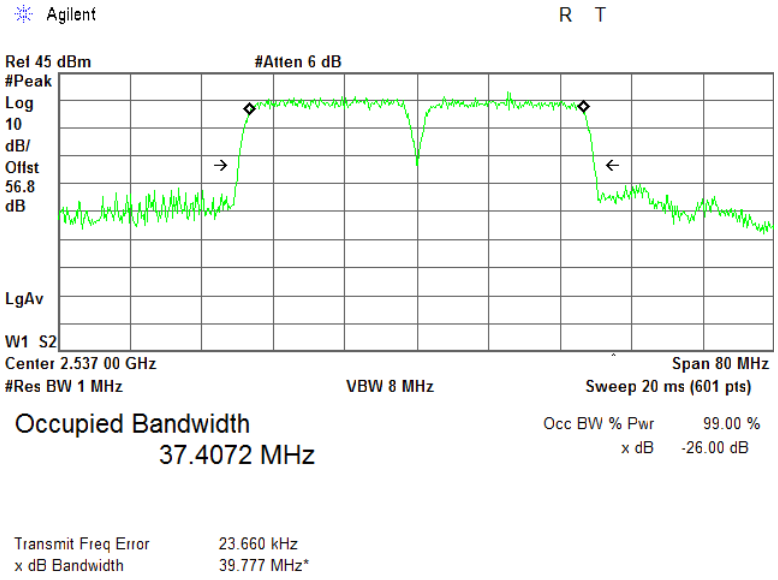
Full description is given in Appendix A.

Test specification:	**Section 2.1049, Occupied bandwidth**		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	21-Mar-17		
Temperature: 23.2 °C	**Relative Humidity:** 48 %	**Air Pressure:** 1019 hPa	**Power:** 120 VAC
Remarks: Operation in low band 2498.5 – 2565.5 MHz			

Plot 7.2.1 Occupied bandwidth test results at low frequency, 40 MHz EBW, QPSK

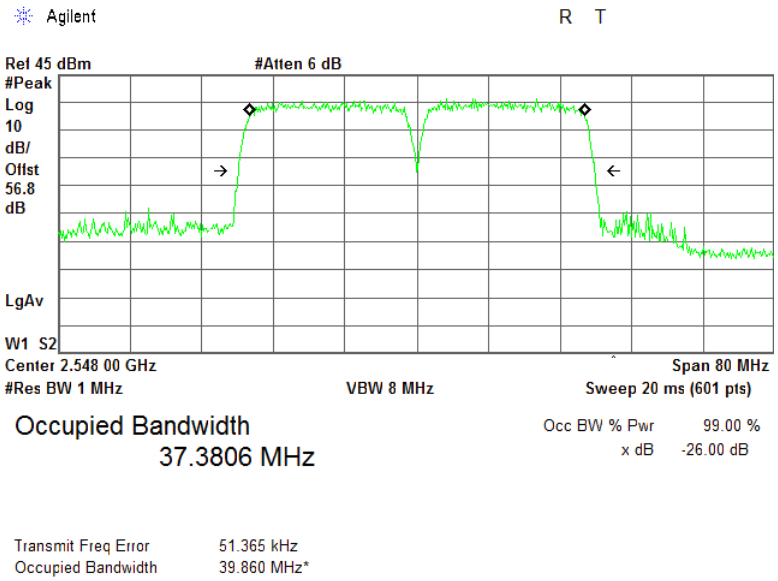


Plot 7.2.2 Occupied bandwidth test results at mid frequency, 40 MHz EBW, QPSK

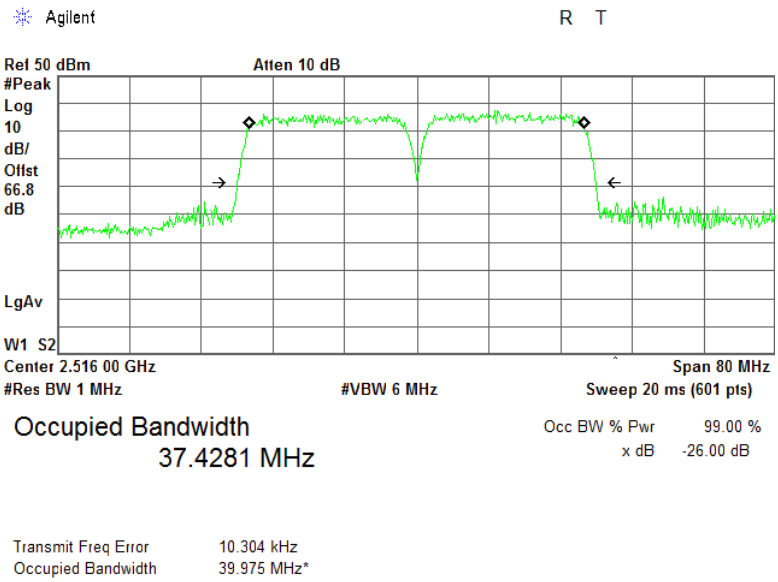


Test specification:	**Section 2.1049, Occupied bandwidth**		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	21-Mar-17		
Temperature: 23.2 °C	**Relative Humidity:** 48 %	**Air Pressure:** 1019 hPa	**Power:** 120 VAC
Remarks: Operation in low band 2498.5 – 2565.5 MHz			

Plot 7.2.3 Occupied bandwidth test results at high frequency, 40 MHz EBW, QPSK

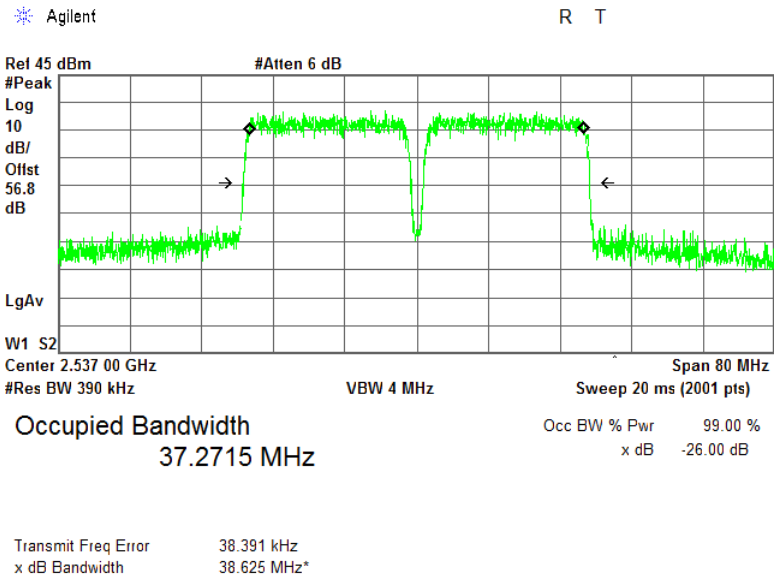


Plot 7.2.4 Occupied bandwidth test results at low frequency, 40 MHz EBW, 64QAM

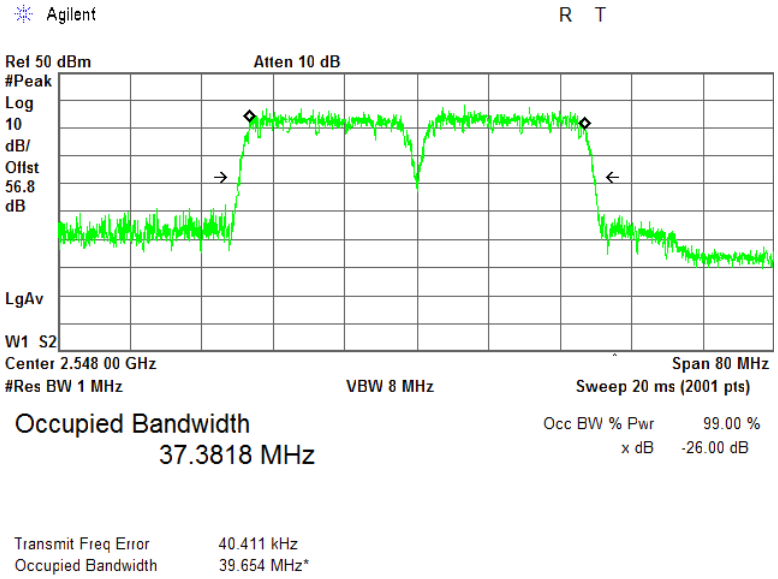


Test specification:	Section 2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Mar-17		
Temperature: 23.2 °C	Relative Humidity: 48 %	Air Pressure: 1019 hPa	Power: 120 VAC
Remarks: Operation in low band 2498.5 – 2565.5 MHz			

Plot 7.2.5 Occupied bandwidth test results at mid frequency, 40 MHz EBW, 64QAM



Plot 7.2.6 Occupied bandwidth test results at high frequency, 40 MHz EBW, 64QAM



Test specification:	Section 2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Feb-17		
Temperature: 23.1 ºC	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 120 VAC
Remarks: Operation in high band 2620.5 – 2687.5 MHz			

7.3 Occupied bandwidth test in 2620.5 – 2687.5 MHz band

7.3.1 General

This test was performed to measure transmitter occupied bandwidth. Specification test limits are given in Table 7.3.1.

Table 7.3.1 Occupied bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, %	Maximum allowed bandwidth, kHz
2614.0 – 2690.0 MHz	99%	NA

* - Modulation envelope reference points are provided in terms of attenuation below the unmodulated carrier.

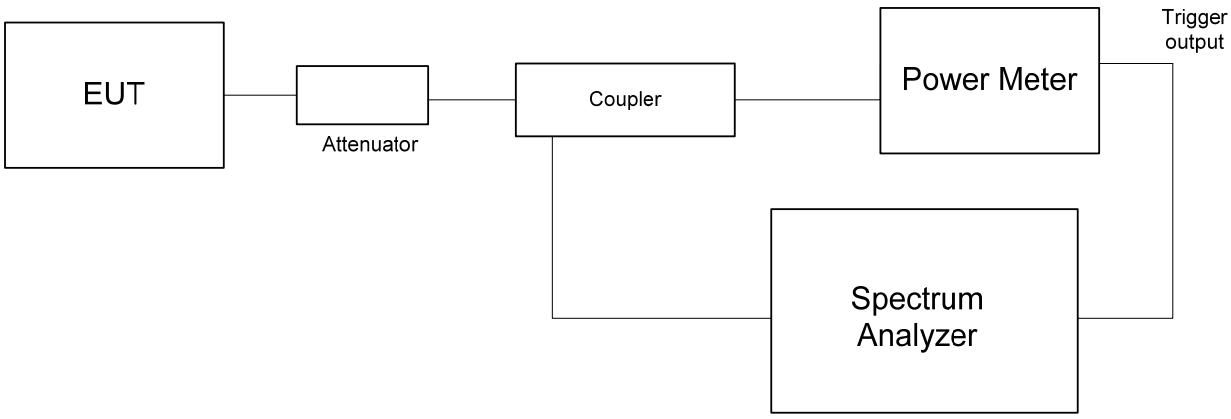
7.3.2 Test procedure

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 set to transmit the normal modulated signal and actual channel width was measured at the 26 dBc modulation envelope reference points.

7.3.2.3 The transmitter occupied bandwidth was measured with spectrum analyzer as a frequency delta between the reference points on modulation envelope and provided in Table 7.3.2 and the associated plots.

Figure 7.3.1 Occupied bandwidth test setup



Test specification:	**Section 2.1049, Occupied bandwidth**		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	22-Feb-17		
Temperature: 23.1 ºC	**Relative Humidity:** 47 %	**Air Pressure:** 1016 hPa	**Power:** 120 VAC
Remarks: Operation in high band 2620.5 – 2687.5 MHz			

Table 7.3.2 Occupied bandwidth test results

DETECTOR USED: Peak
RESOLUTION BANDWIDTH: ≥390 kHz
MODULATION ENVELOPE REFERENCE POINTS: 99%
EBW: 40 MHz

Carrier frequency, MHz	OBW 26 dBc, MHz	OBW 99%. MHz	Limit, kHz	Verdict
QPSK				
2638.0	39.822	37.354	NA	Pass
2653.5	39.813	37.453	NA	Pass
2670.0	39.694	37.466	NA	Pass
64QAM				
2638.0	38.691	37.315	NA	Pass
2653.5	39.700	37.356	NA	Pass
2670.0	39.546	37.394	NA	Pass

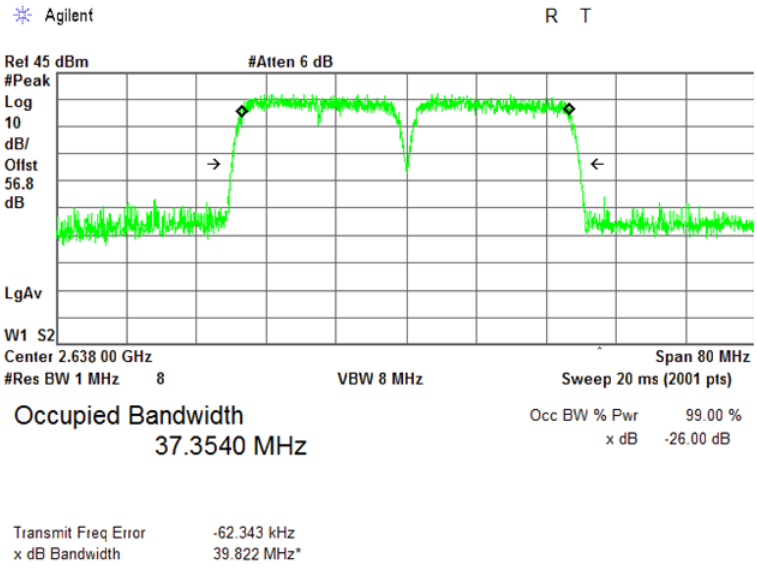
Reference numbers of test equipment used

HL 2214	HL 3301	HL 3302	HL 4274	HL 4575			

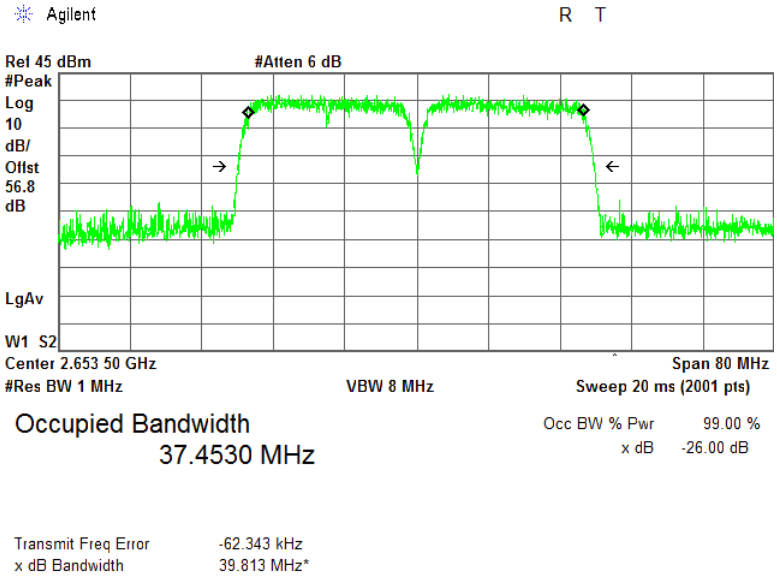
Full description is given in Appendix A.

Test specification:	Section 2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Feb-17		
Temperature: 23.1 °C	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 120 VAC
Remarks: Operation in high band 2620.5 – 2687.5 MHz			

Plot 7.3.1 Occupied bandwidth test results at low frequency, 40 MHz EBW, QPSK

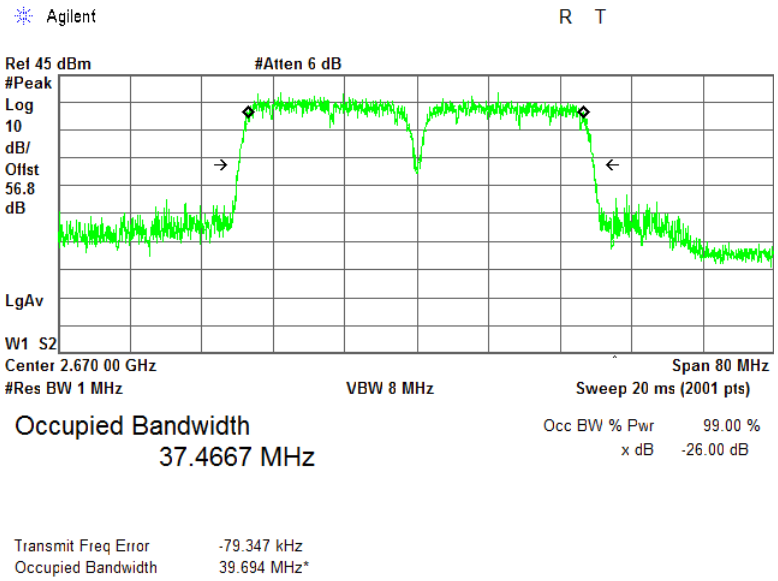


Plot 7.3.2 Occupied bandwidth test results at mid frequency, 40 MHz EBW, QPSK

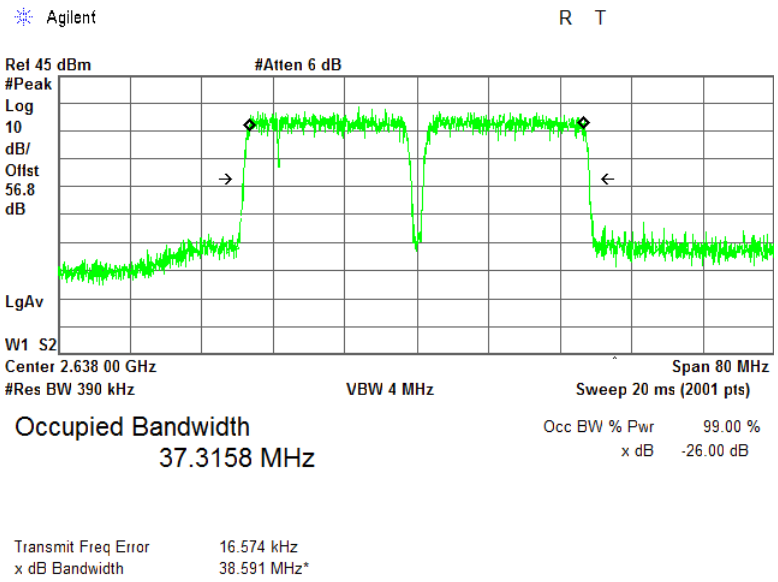


Test specification:	Section 2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Feb-17		
Temperature: 23.1 °C	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 120 VAC
Remarks: Operation in high band 2620.5 – 2687.5 MHz			

Plot 7.3.3 Occupied bandwidth test results at high frequency, 40 MHz EBW, QPSK

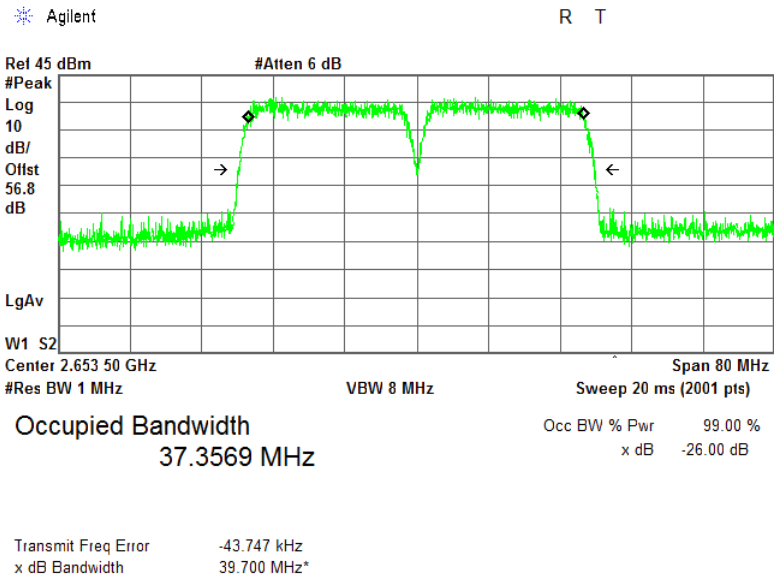


Plot 7.3.4 Occupied bandwidth test results at low frequency, 40 MHz EBW, 64QAM

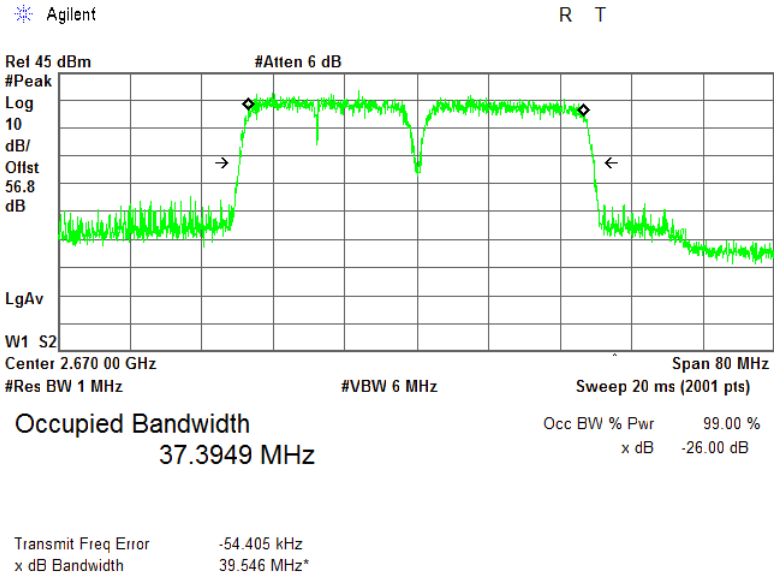


Test specification:	Section 2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Feb-17		
Temperature: 23.1 °C	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 120 VAC
Remarks: Operation in high band 2620.5 – 2687.5 MHz			

Plot 7.3.5 Occupied bandwidth test results at mid frequency, 40 MHz EBW, 64QAM



Plot 7.3.6 Occupied bandwidth test results at high frequency, 40 MHz EBW, 64QAM



Test specification:	Section 27.50, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	20-Feb-17 - 21-Feb-17		
Temperature: 23.2 ºC	Relative Humidity: 48 %	Air Pressure: 1019 hPa	Power: 120 VAC
Remarks: Operation in full band 2498.5-2687.5 MHz			

7.4 Maximum output power test in 2498.5-2687.5 MHz band

7.4.1 General

This test was performed to measure the peak output power at RF antenna connector. Specification test limits are given in Table 7.4.1.

Table 7.4.1 Maximum output power limits

Transmitter type	Assigned frequency range, MHz	Maximum peak output power dBm
Main, booster and base stations	2496.0 – 2690.0	63+10log(X/Y)+10log(360/beamwidth)
		Maximum peak power density dBm/100 kHz
		EIRP+10log(0.1/Y)

*- X is the actual channel width in MHz (occupied bandwidth), Y is either

1) 6 MHz if prior to transition or the station is in the MBS following transition or
2) 5.5 MHz if the station is in the LBS and UBS following transition, and
3) beamwidth is the total horizontal plane beam width of the individual transmitting antenna for the station or any sector measured at the half-power points.

7.4.2 Test procedure

7.4.2.1 The EUT was set up as shown in Figure 7.4.1, energized and its proper operation was checked.

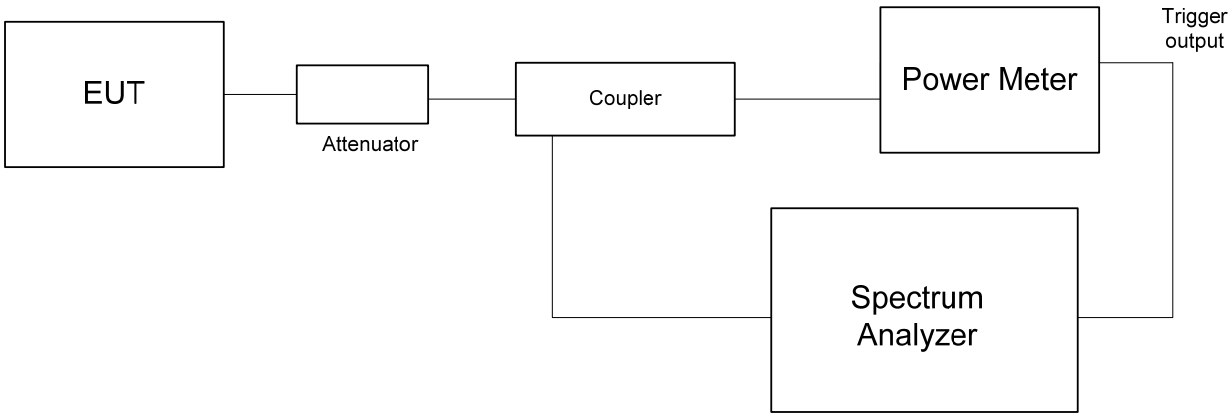
7.4.2.2 The EUT was adjusted to produce maximum available to the end user RF output power.

7.4.2.3 The average output powe was measured with power meter as provided in Table 7.4.2.

7.4.2.4 The power spectral density was measured with spectrum analyzer as provided in Table 7.4.3.

7.4.2.5 The test results are provided in the tables below and associated plots.

Figure 7.4.1 Peak output power test setup



Test specification:	**Section 27.50, Peak output power**		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	20-Feb-17 - 21-Feb-17		
Temperature: 23.2 ºC	**Relative Humidity:** 48 %	**Air Pressure:** 1019 hPa	**Power:** 120 VAC
Remarks: Operation in full band 2498.5-2687.5 MHz			

Table 7.4.2 Peak output power test results

DETECTOR USED: Average within Tx burst
DUTY CYCLE: 55%
EBW: 40 MHz

Carrier frequency, MHz	Power Meter reading RF#1, dBm	Power Meter reading RF#2, dBm	Total RF power**, dBm	Antenna gain, dBi	Total EIRP*, dBm	Limit***, dBm	Margin, dB	Verdict
QPSK								
2516.0	42.20	42.25	45.23	18.0	63.23	69.68	-6.46	Pass
2594.0	42.65	42.41	45.53	18.0	63.53	69.93	-6.40	Pass
2670.0	42.29	42.30	45.30	18.0	63.30	69.73	-6.44	Pass
64QAM								
2516.0	42.71	42.78	45.75	18.0	63.75	69.68	-5.94	Pass
2594.0	42.67	42.87	45.77	18.0	63.77	69.92	-6.15	Pass
2670.0	42.37	42.22	45.30	18.0	63.30	69.72	-6.43	Pass
QPSK								
2516.0	42.20	42.25	45.23	17.0	62.23	68.27	-6.04	Pass
2594.0	42.65	42.41	45.53	17.0	62.53	68.52	-5.99	Pass
2670.0	42.29	42.30	45.30	17.0	62.30	68.32	-6.02	Pass
64QAM								
2516.0	42.71	42.78	45.75	17.0	62.75	68.27	-5.52	Pass
2594.0	42.67	42.87	45.77	17.0	62.77	68.51	-5.74	Pass
2670.0	42.37	42.22	45.30	17.0	62.30	68.31	-6.01	Pass
QPSK								
2516.0	42.20	42.25	45.23	11.0	56.23	69.68	-13.46	Pass
2594.0	42.65	42.41	45.53	11.0	56.53	69.93	-13.40	Pass
2670.0	42.29	42.30	45.30	11.0	56.30	69.73	-13.44	Pass
64QAM								
2516.0	42.71	42.78	45.75	11.0	56.75	69.68	-12.94	Pass
2594.0	42.67	42.87	45.77	11.0	56.77	69.92	-13.15	Pass
2670.0	42.37	42.22	45.30	11.0	56.30	69.72	-13.43	Pass

* - EIRP total, dBm = Total RF power**, dBm + Antenna Gain, dBi
** - Total RF power , dBm = 10*log[10^(Power RF#1 /10) + 10^(Power RF#2 /10)
*** - See Table 7.4.5.

Reference numbers of test equipment used

HL 2214	HL 3301	HL 3302					

Full description is given in Appendix A.

Test specification:	Section 27.50, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	20-Feb-17 - 21-Feb-17		
Temperature: 23.2 ºC	Relative Humidity: 48 %	Air Pressure: 1019 hPa	Power: 120 VAC
Remarks: Operation in full band 2498.5-2687.5 MHz			

Table 7.4.3 Power spectral density test results

DETECTOR USED: Average gated
RESOLUTION BANDWIDTH: 100 kHz
VIDEO BANDWIDTH: 300 kHz
CHANNEL BANDWIDTH: 40 MHz
DUTY CYCLE: 55%
NUMBER OUTPUTS: N=2

Carrier frequency, MHz	SA reading*, RF #1 or RF#2 dBm/100kHz	Total PSD dBm/100kHz	Antenna gain, dBi	Total EIRP PSD**, dBm/100kHz	Limit***, dBm	Margin, dB	Verdict
QPSK							
2516.0	18.76	21.76	18.0	39.76	43.20	-3.44	Pass
2594.0	18.37	21.37	18.0	39.37	43.70	-4.33	Pass
2670.0	18.21	21.21	18.0	39.21	43.30	-4.09	Pass
64 QAM							
2516.0	19.18	22.18	18.0	40.18	43.20	-3.02	Pass
2594.0	19.03	22.03	18.0	40.03	43.69	-3.66	Pass
2670.0	18.67	21.67	18.0	39.67	43.29	-3.62	Pass
QPSK							
2516.0	18.76	21.76	17.0	38.76	41.78	-3.02	Pass
2594.0	18.37	21.37	17.0	38.37	42.29	-3.92	Pass
2670.0	18.21	21.21	17.0	38.21	41.88	-3.67	Pass
64 QAM							
2516.0	19.18	22.18	17.0	39.18	41.79	-2.61	Pass
2594.0	19.03	22.03	17.0	39.03	42.28	-3.25	Pass
2670.0	18.67	21.67	17.0	38.67	41.87	-3.20	Pass
QPSK							
2516.0	18.76	21.76	11.0	32.76	43.20	-10.44	Pass
2594.0	18.37	21.37	11.0	32.37	43.70	-11.33	Pass
2670.0	18.21	21.21	11.0	32.21	43.30	-11.09	Pass
64 QAM							
2516.0	19.18	22.18	11.0	33.18	43.20	-10.02	Pass
2594.0	19.03	22.03	11.0	33.03	43.69	-10.66	Pass
2670.0	18.67	21.67	11.0	32.67	43.29	-10.62	Pass

* SA reading including attenuation, cable loss and Duty Cycle correction factor
** Total EIRP PSD, dBm/100kHz = SA reading Max (dBm/100kHz,RF#1or RF#2)+ 3 dB + Antenna Gain, dBi
*** See Table 7.4.6.

Reference numbers of test equipment used

HL 2214	HL 3301	HL 3302	HL 3818	HL 3901			

Full description is given in Appendix A.

Test specification:	Section 27.50, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	20-Feb-17 - 21-Feb-17		
Temperature: 23.2 ºC	Relative Humidity: 48 %	Air Pressure: 1019 hPa	Power: 120 VAC
Remarks: Operation in full band 2498.5-2687.5 MHz			

Table 7.4.4 Post- transition frequency channels assignment

Channel	OBW, MHz	Peak power limit, dBm	Power density limit, dBm/100kHz
40 MHz 4 Channels QPSK 46.4 Mbps			
2516.0 MHz BRS1+EBS A1+A2+A3+B1+B2+B3+C1	37.412	63+10log(OBW/44.5)+ 10log(360/beamwidth)	EIRP+10log(0.1/22.5)
2594.0 MHz EBS A4+B4+C4+D4+G4+F4+E4	37.434	63+10log(OBW/42.0)+ 10log(360/beamwidth)	EIRP+10log(0.1/24.0)
2670.0 MHz BRS/EBS F2+F3+BRS H1+H2+H3+EBS G1+G2+G3	37.428	63+10log(OBW/44.0)+ 10log(360/beamwidth)	EIRP+10log(0.1/22.0)
40 MHz 4 Channels 64QAM 190 Mbps			
2516.0 MHz BRS1+EBS A1+A2+A3+B1+B2+B3+C1	37.428	63+10log(OBW/44.5)+ 10log(360/beamwidth)	EIRP+10log(0.1/22.5)
2594.0 MHz EBS A4+B4+C4+D4+G4+F4+E4	37.346	63+10log(OBW/42.0)+ 10log(360/beamwidth)	EIRP+10log(0.1/24.0)
2670.0 MHz BRS/EBS F2+F3+BRS H1+H2+H3+EBS G1+G2+G3	37.339	63+10log(OBW/44.0)+ 10log(360/beamwidth)	EIRP+10log(0.1/22.0)

Table 7.4.5 EIRP limits

Channel	Channel BW, MHz	Peak power limit, dBm	
		17 dBi, 90º beamwidth	18 dBi, 65ºbeamwidth 11 dBi, 65ºbeamwidth
40 MHz Dual Channel QPSK			
2516.0 MHz BRS1+EBS A1+A2+A3+B1+B2+B3+C1	44.5	68.27	69.68
2594.0 MHz EBS A4+B4+C4+D4+G4+F4+E4	42.0	68.52	69.93
2670.0 MHz BRS/EBS F2+F3+BRS H1+H2+H3+EBS G1+G2+G3	44.0	68.32	69.73
40 MHz Dual Channel 64 QAM			
2516.0 MHz BRS1+EBS A1+A2+A3+B1+B2+B3+C1	44.5	68.27	69.68
2594.0 MHz EBS A4+B4+C4+D4+G4+F4+E4	42.0	68.51	69.92
2670.0 MHz BRS/EBS F2+F3+BRS H1+H2+H3+EBS G1+G2+G3	44.0	68.31	69.72

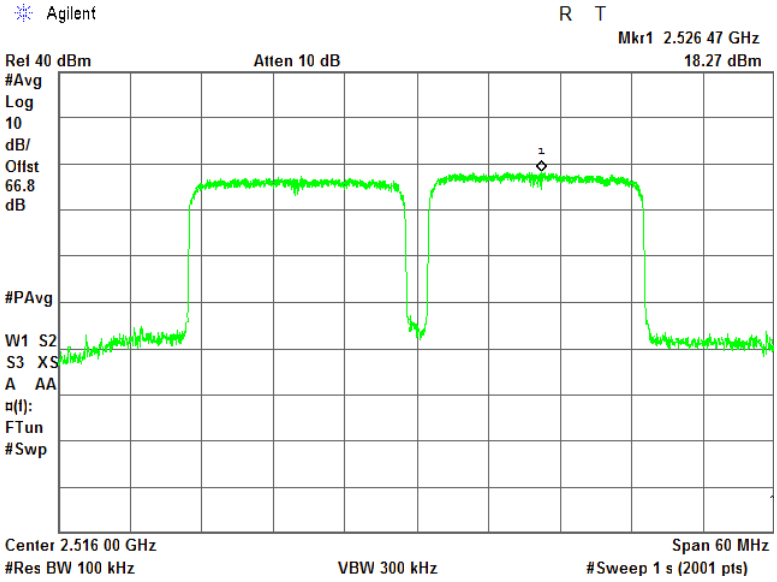
Test specification:	Section 27.50, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	20-Feb-17 - 21-Feb-17		
Temperature: 23.2 ºC	Relative Humidity: 48 %	Air Pressure: 1019 hPa	Power: 120 VAC
Remarks: Operation in full band 2498.5-2687.5 MHz			

Table 7.4.6 Peak power density limits

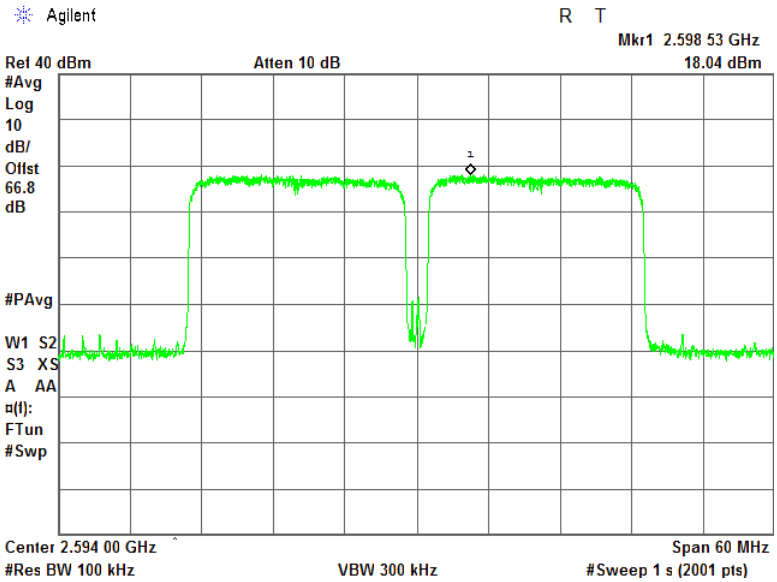
Channel	Channel BW, MHz	Peak power density, dBm/100kHz	
		17 dBi, 90º beamwidth	18 dBi, 65ºbeamwidth 11 dBi, 65ºbeamwidth
40 MHz Dual Channel QPSK			
2516.0 MHz BRS1+EBS A1+A2+A3+B1+B2+B3+C1	44.5	41.78	43.20
2594.0 MHz EBS A4+B4+C4+D4+G4+F4+E4	42.0	42.29	43.70
2670.0 MHz BRS/EBS F2+F3+BRS H1+H2+H3+EBS G1+G2+G3	44.0	41.88	43.30
40 MHz Dual Channel 64 QAM			
2516.0 MHz BRS1+EBS A1+A2+A3+B1+B2+B3+C1	44.5	41.79	43.20
2594.0 MHz EBS A4+B4+C4+D4+G4+F4+E4	42.0	42.29	43.69
2670.0 MHz BRS/EBS F2+F3+BRS H1+H2+H3+EBS G1+G2+G3	44.0	41.88	43.29

Test specification:	Section 27.50, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	20-Feb-17 - 21-Feb-17		
Temperature: 23.2 °C	Relative Humidity: 48 %	Air Pressure: 1019 hPa	Power: 120 VAC
Remarks: Operation in full band 2498.5-2687.5 MHz			

Plot 7.4.1 Peak output power test results at low frequency, 40 MHz, QPSK RF # 1

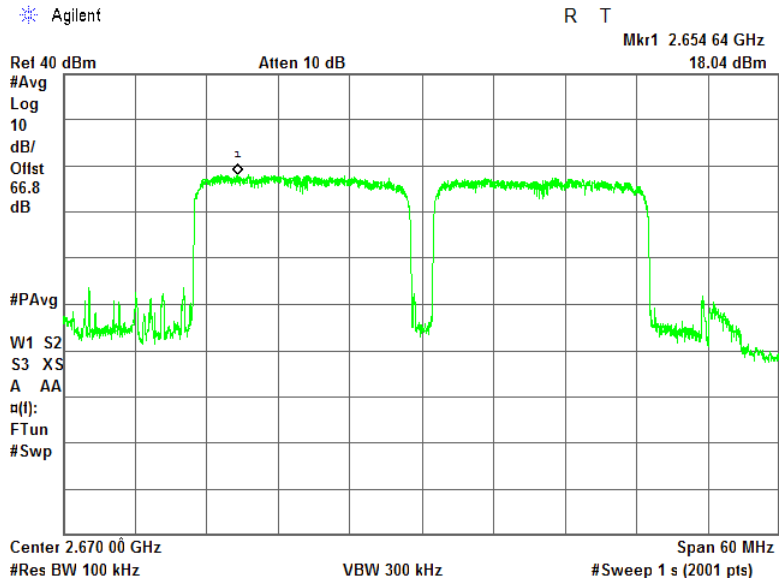


Plot 7.4.2 Peak output power test results at mid frequency, 40 MHz, QPSK RF # 1

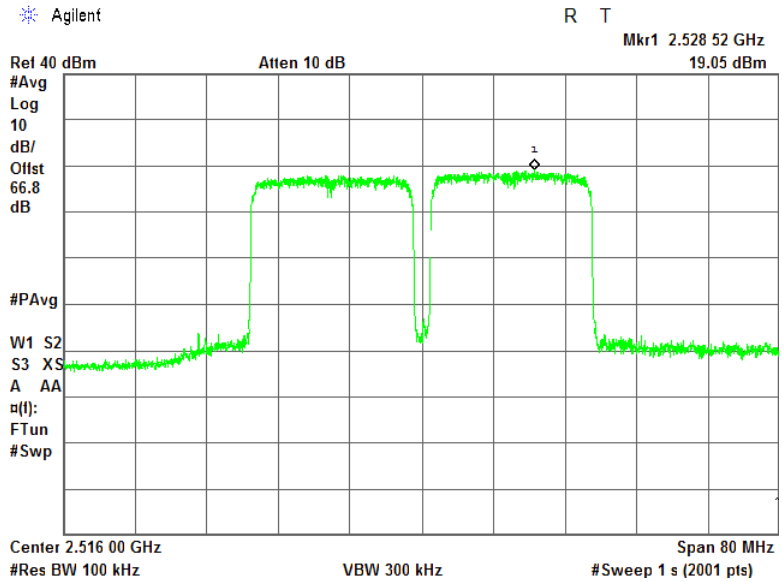


Test specification:	Section 27.50, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	20-Feb-17 - 21-Feb-17		
Temperature: 23.2 °C	Relative Humidity: 48 %	Air Pressure: 1019 hPa	Power: 120 VAC
Remarks: Operation in full band 2498.5-2687.5 MHz			

Plot 7.4.3 Peak output power test results at high frequency, 40 MHz, QPSK RF # 1

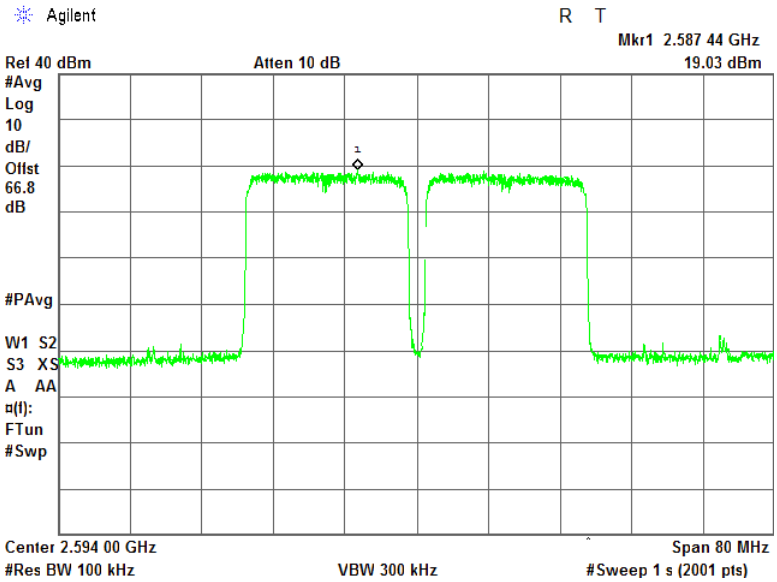


Plot 7.4.4 Peak output power test results at low frequency, 40 MHz, 64QAM RF # 1

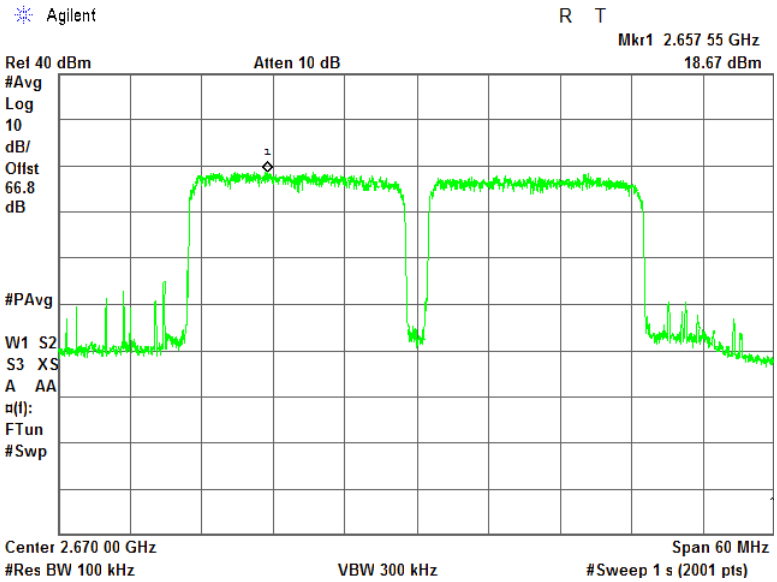


Test specification:	Section 27.50, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	20-Feb-17 - 21-Feb-17		
Temperature: 23.2 °C	Relative Humidity: 48 %	Air Pressure: 1019 hPa	Power: 120 VAC
Remarks: Operation in full band 2498.5-2687.5 MHz			

Plot 7.4.5 Peak output power test results at mid frequency, 40 MHz, 64QAM RF # 1

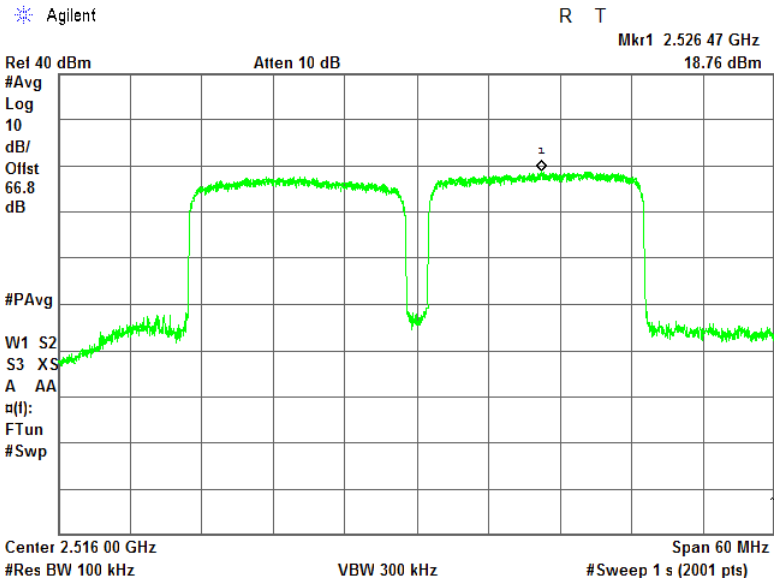


Plot 7.4.6 Peak output power test results at high frequency, 40 MHz, 64QAM RF # 1

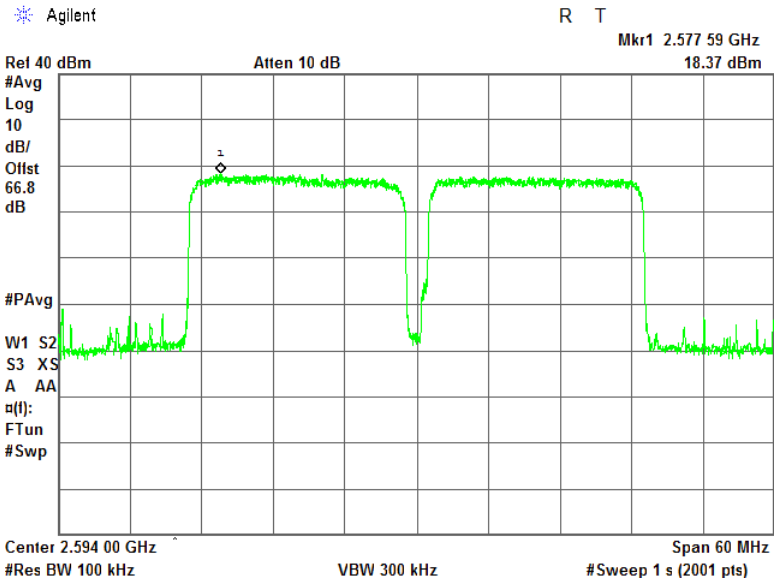


Test specification:	Section 27.50, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	20-Feb-17 - 21-Feb-17		
Temperature: 23.2 °C	Relative Humidity: 48 %	Air Pressure: 1019 hPa	Power: 120 VAC
Remarks: Operation in full band 2498.5-2687.5 MHz			

Plot 7.4.7 Peak output power test results at low frequency, 40 MHz, QPSK RF # 2

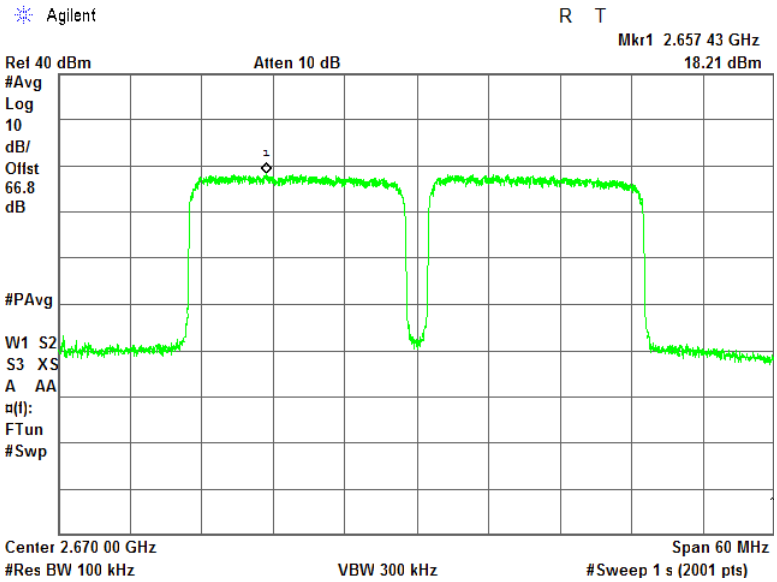


Plot 7.4.8 Peak output power test results at mid frequency, 40 MHz, QPSK RF # 2

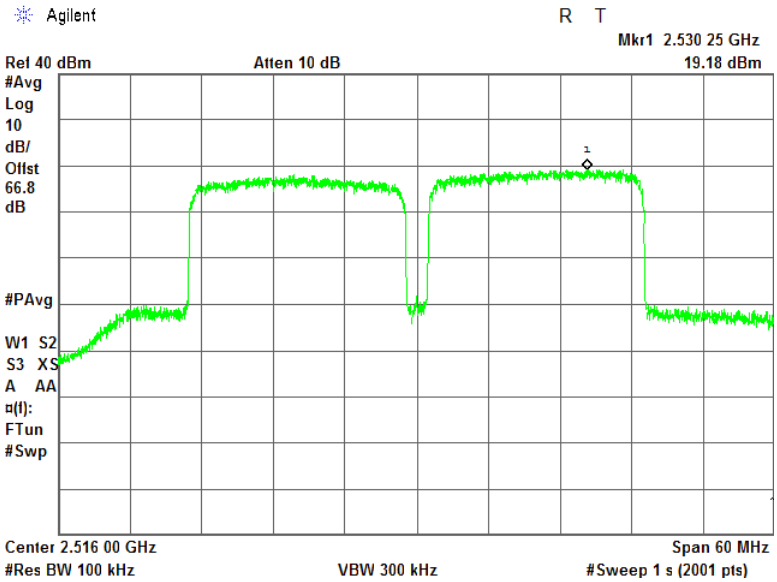


Test specification:	Section 27.50, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	20-Feb-17 - 21-Feb-17		
Temperature: 23.2 °C	Relative Humidity: 48 %	Air Pressure: 1019 hPa	Power: 120 VAC
Remarks: Operation in full band 2498.5-2687.5 MHz			

Plot 7.4.9 Peak output power test results at high frequency, 40 MHz, QPSK RF # 2

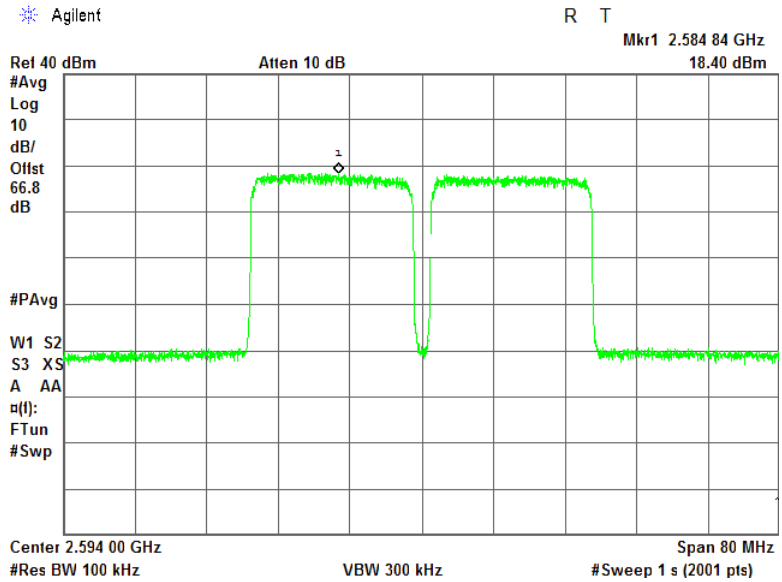


Plot 7.4.10 Peak output power test results at low frequency, 40 MHz, 64QAM RF # 2

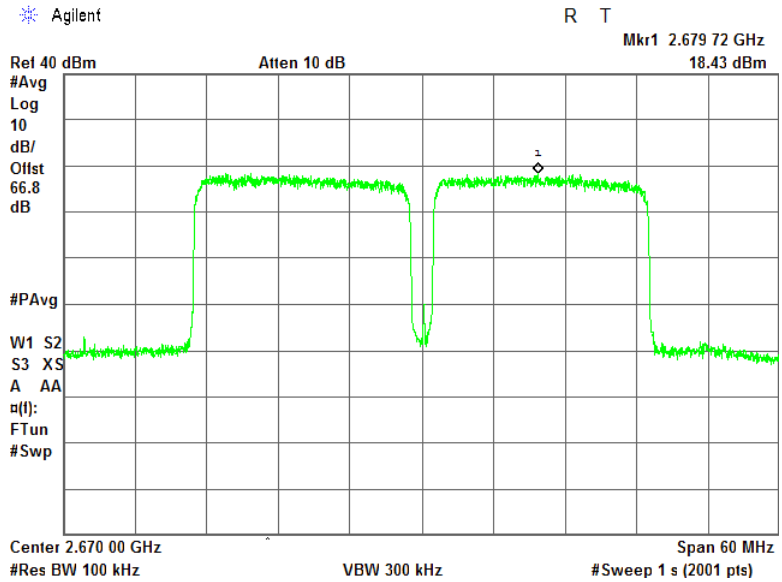


Test specification:	Section 27.50, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	20-Feb-17 - 21-Feb-17		
Temperature: 23.2 °C	Relative Humidity: 48 %	Air Pressure: 1019 hPa	Power: 120 VAC
Remarks: Operation in full band 2498.5-2687.5 MHz			

Plot 7.4.11 Peak output power test results at mid frequency, 40 MHz, 64QAM RF # 2



Plot 7.4.12 Peak output power test results at high frequency, 40 MHz, 64QAM RF # 2



Test specification:	Section 27.50, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Feb-17 - 22-Feb-17		
Temperature: 23.1 ºC	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 120 VAC
Remarks: Operation in low band 2498.5 – 2565.5 MHz			

7.5 Maximum output power test in 2498.5-2565.5 MHz band

7.5.1 General

This test was performed to measure the peak output power at RF antenna connector. Specification test limits are given in Table 7.5.1.

Table 7.5.1 Maximum output power limits

Transmitter type	Assigned frequency range, MHz	Maximum peak output power dBm
Main, booster and base stations	2496.0 – 2572.0	63+10log(X/Y)+10log(360/beamwidth)
		Maximum peak power density dBm/100 kHz
		EIRP+10log(0.1/Y)

*- X is the actual channel width in MHz (occupied bandwidth), Y is either

1) 6 MHz if prior to transition or the station is in the MBS following transition or
2) 5.5 MHz if the station is in the LBS and UBS following transition, and
3) beamwidth is the total horizontal plane beam width of the individual transmitting antenna for the station or any sector measured at the half-power points.

7.5.2 Test procedure

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

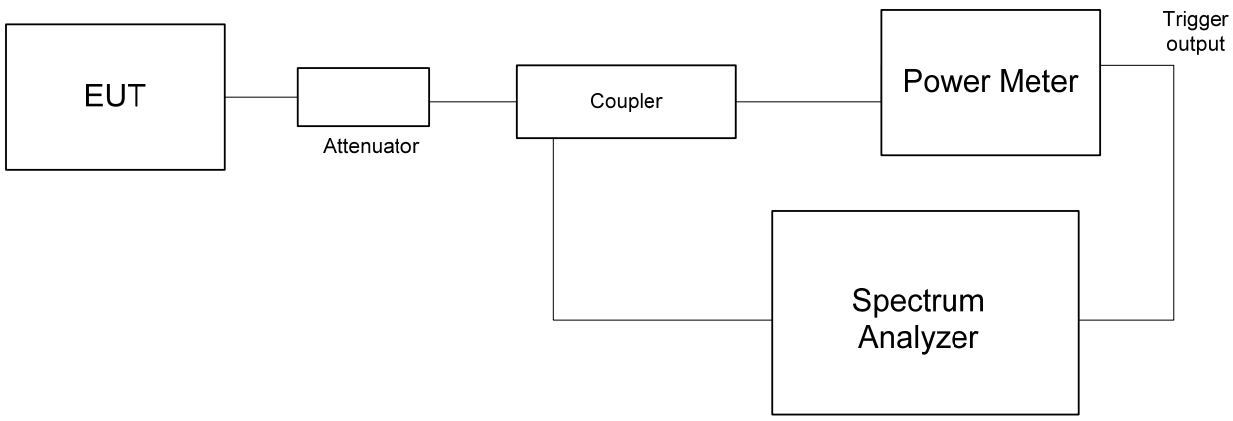
7.5.2.2 The EUT was adjusted to produce maximum available to the end user RF output power.

7.5.2.3 The average output powe was measured with power meter as provided in Table 7.5.2.

7.5.2.4 The power spectral density was measured with spectrum analyzer as provided in Table 7.5.3.

7.5.2.5 The test results are provided in the tables below and associated plots.

Figure 7.5.1 Peak output power test setup



Test specification:	**Section 27.50, Peak output power**		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	21-Feb-17 - 22-Feb-17		
Temperature: 23.1 ºC	**Relative Humidity:** 47 %	**Air Pressure:** 1016 hPa	**Power:** 120 VAC
Remarks: Operation in low band 2498.5 – 2565.5 MHz			

Table 7.5.2 Peak output power test results

DETECTOR USED: Average within Tx burst
DUTY CYCLE: 55%
EBW: 40 MHz

Carrier frequency, MHz	Power Meter reading RF#1, dBm	Power Meter reading RF#2, dBm	Total RF power**, dBm	Antenna gain, dBi	Total EIRP*, dBm	Limit***, dBm	Margin, dB	Verdict
QPSK								
2516.0	42.63	42.48	45.56	18.0	63.56	69.68	-6.12	Pass
2537.0	42.67	42.33	45.50	18.0	63.50	69.73	-6.23	Pass
2548.0	42.56	42.44	45.50	18.0	63.50	69.73	-6.23	Pass
64QAM								
2516.0	42.65	42.47	45.56	18.0	63.56	69.68	-6.12	Pass
2537.0	42.48	42.56	45.52	18.0	63.52	69.71	-6.19	Pass
2548.0	42.46	42.66	45.56	18.0	63.56	69.73	-6.16	Pass
QPSK								
2516.0	42.63	42.48	45.56	17.0	62.56	68.27	-5.71	Pass
2537.0	42.67	42.33	45.50	17.0	62.52	68.32	-5.80	Pass
2548.0	42.56	42.44	45.50	17.0	62.50	68.31	-5.81	Pass
64QAM								
2516.0	42.65	42.47	45.56	17.0	62.58	68.27	-5.69	Pass
2537.0	42.48	42.56	45.52	17.0	62.52	68.30	-5.78	Pass
2548.0	42.46	42.66	45.56	17.0	62.58	68.31	-5.74	Pass
QPSK								
2516.0	42.63	42.48	45.56	11.0	56.56	69.68	-13.12	Pass
2537.0	42.67	42.33	45.50	11.0	56.50	69.73	-13.23	Pass
2548.0	42.56	42.44	45.50	11.0	56.50	69.73	-13.23	Pass
64QAM								
2516.0	42.65	42.47	45.56	11.0	56.56	69.68	-13.12	Pass
2537.0	42.48	42.56	45.52	11.0	56.52	69.71	-13.19	Pass
2548.0	42.46	42.66	45.56	11.0	56.56	69.73	-13.16	Pass

* - EIRP total, dBm = Total RF power**, dBm + Antenna Gain, dBi
** - Total RF power , dBm = 10*log[10^(Power RF#1 /10) + 10^(Power RF#2 /10)
*** - See Table 7.5.5.**Error! Reference source not found.**

Reference numbers of test equipment used

HL 2214	HL 3301	HL 3302					

Full description is given in Appendix A.

Test specification:	**Section 27.50, Peak output power**		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	21-Feb-17 - 22-Feb-17		
Temperature: 23.1 ºC	**Relative Humidity:** 47 %	**Air Pressure:** 1016 hPa	**Power:** 120 VAC
Remarks: Operation in low band 2498.5 – 2565.5 MHz			

Table 7.5.3 Power spectral density test results

DETECTOR USED: Average gated
RESOLUTION BANDWIDTH: 100 kHz
VIDEO BANDWIDTH: 300 kHz
CHANNEL BANDWIDTH: 40 MHz
DUTY CYCLE: 55%
NUMBER OUTPUTS: N=2

Carrier frequency, MHz	SA reading*, RF #1 or RF#2 dBm/100kHz	Total PSD dBm/100kHz	Antenna gain, dBi	Total EIRP PSD**, dBm/100kHz	Limit***, dBm	Margin, dB	Verdict
QPSK							
2516.0	17.59	20.59	18.0	38.59	43.19	-4.60	Pass
2537.0	18.56	21.56	18.0	39.56	43.29	-3.73	Pass
2548.0	18.21	21.21	18.0	39.21	43.29	-4.08	Pass
64 QAM							
2516.0	18.73	21.73	18.0	39.73	43.20	-3.47	Pass
2537.0	18.72	21.72	18.0	39.72	43.28	-3.56	Pass
2548.0	18.57	21.57	18.0	39.57	43.29	-3.72	Pass
QPSK							
2516.0	17.59	20.59	17.0	37.59	41.78	-4.19	Pass
2537.0	18.56	21.56	17.0	38.56	41.88	-3.32	Pass
2548.0	18.21	21.21	17.0	38.21	41.88	-3.67	Pass
64 QAM							
2516.0	18.73	21.73	17.0	38.73	41.79	-3.06	Pass
2537.0	18.72	21.72	17.0	38.72	41.88	-3.16	Pass
2548.0	18.57	21.57	17.0	38.57	41.88	-3.31	Pass
QPSK							
2516.0	17.59	20.59	11.0	31.59	43.19	-11.60	Pass
2537.0	18.56	21.56	11.0	32.56	43.29	-10.73	Pass
2548.0	18.21	21.21	11.0	32.21	43.29	-11.08	Pass
64 QAM							
2516.0	18.73	21.73	11.0	32.73	43.20	-10.47	Pass
2537.0	18.72	21.72	11.0	32.72	43.28	-10.56	Pass
2548.0	18.57	21.57	11.0	32.57	43.29	-10.72	Pass

* SA reading including attenuation, cable loss and Duty Cycle correction factor
** Total EIRP PSD, dBm/100kHz = SA reading Max (dBm/100kHz,RF#1or RF#2)+ 10*log(N) dB + Antenna Gain, dBi
*** See Table 7.5.6.

Reference numbers of test equipment used

HL 2214	HL 3301	HL 3302	HL 3818	HL 3901			

Full description is given in Appendix A.

Test specification:	Section 27.50, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Feb-17 - 22-Feb-17		
Temperature: 23.1 ºC	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 120 VAC
Remarks: Operation in low band 2498.5 – 2565.5 MHz			

Table 7.5.4 Post- transition frequency channels assignment

Channel	OBW, MHz	Peak power limit, dBm	Power density limit, dBm/100kHz
40 MHz 4 Channels QPSK 46.4 Mbps			
2516.0 MHz BRS1+EBS A1+A2+A3+B1+B2+B3+C1	37.396	63+10log(OBW/44.5)+ 10log(360/beamwidth)	EIRP+10log(0.1/22.5)
2537.0 MHz EBS A3+B1+B2+B3+C1+C2+C3+D1	37.407	63+10log(OBW/44.0)+ 10log(360/beamwidth)	EIRP+10log(0.1/24.0)
2548.0 MHz EBS B2+B3+C1+C2+C3+D1+D2+D3	37.380	63+10log(OBW/44.0)+ 10log(360/beamwidth)	EIRP+10log(0.1/22.0)
40 MHz 4 Channels 64QAM 190 Mbps			
2516.0 MHz BRS1+EBS A1+A2+A3+B1+B2+B3+C1	37.428	63+10log(OBW/44.5)+ 10log(360/beamwidth)	EIRP+10log(0.1/22.5)
2537.0 MHz EBS A3+B1+B2+B3+C1+C2+C3+D1	37.271	63+10log(OBW/44.0)+ 10log(360/beamwidth)	EIRP+10log(0.1/24.0)
2548.0 MHz EBS B2+B3+C1+C2+C3+D1+D2+D3	37.381	63+10log(OBW/44.0)+ 10log(360/beamwidth)	EIRP+10log(0.1/22.0)

Table 7.5.5 EIRP limits

Channel	Channel BW, MHz	Peak power limit, dBm	
		17 dBi, 90º beamwidth	18 dBi, 65ºbeamwidth 11 dBi, 65ºbeamwidth
40 MHz Dual Channel QPSK			
2516.0 MHz BRS1+EBS A1+A2+A3+B1+B2+B3+C1	44.5	68.27	69.68
2537.0 MHz EBS A3+B1+B2+B3+C1+C2+C3+D1	44.0	68.32	69.73
2548.0 MHz EBS B2+B3+C1+C2+C3+D1+D2+D3	44.0	68.31	69.73
40 MHz Dual Channel 64 QAM			
2516.0 MHz BRS1+EBS A1+A2+A3+B1+B2+B3+C1	44.5	68.27	69.68
2537.0 MHz EBS A3+B1+B2+B3+C1+C2+C3+D1	44.0	68.31	69.71
2548.0 MHz EBS B2+B3+C1+C2+C3+D1+D2+D3	44.0	68.31	69.73

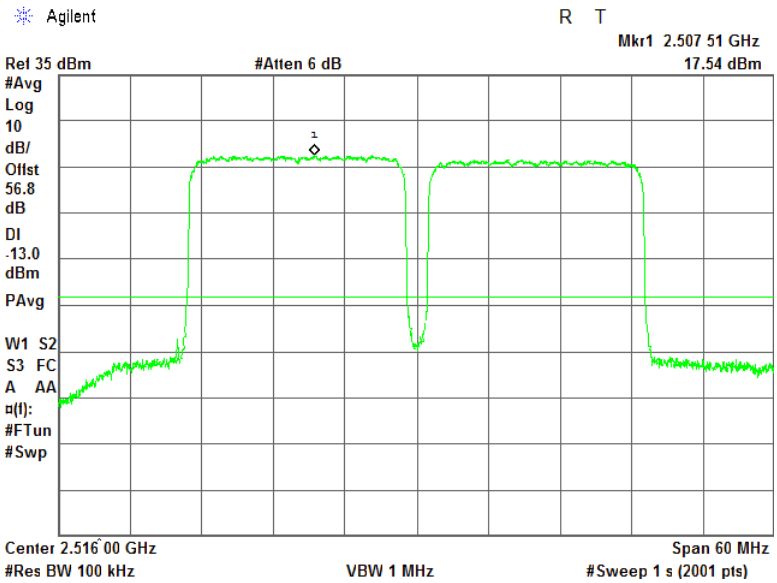
Test specification:	Section 27.50, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Feb-17 - 22-Feb-17		
Temperature: 23.1 ºC	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 120 VAC
Remarks: Operation in low band 2498.5 – 2565.5 MHz			

Table 7.5.6 Peak power density limits

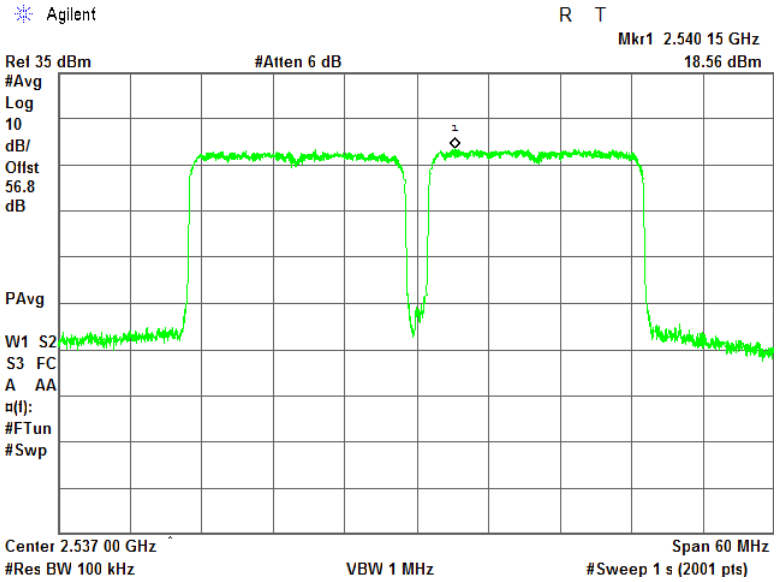
Channel	Channel BW, MHz	Peak power density, dBm/100kHz	
		17 dBi, 90º beamwidth	18 dBi, 65ºbeamwidth 11 dBi, 65ºbeamwidth
40 MHz Dual Channel QPSK			
2516.0 MHz BRS1+EBS A1+A2+A3+B1+B2+B3+C1	44.5	41.78	44.12
2537.0 MHz EBS A3+B1+B2+B3+C1+C2+C3+D1	44.0	41.88	43.29
2548.0 MHz EBS B2+B3+C1+C2+C3+D1+D2+D3	44.0	41.88	43.29
40 MHz Dual Channel 64 QAM			
2516.0 MHz BRS1+EBS A1+A2+A3+B1+B2+B3+C1	44.5	41.79	43.19
2537.0 MHz EBS A3+B1+B2+B3+C1+C2+C3+D1	44.0	41.87	43.28
2548.0 MHz EBS B2+B3+C1+C2+C3+D1+D2+D3	44.0	41.88	43.29

Test specification:	Section 27.50, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Feb-17 - 22-Feb-17		
Temperature: 23.1 °C	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 120 VAC
Remarks: Operation in low band 2498.5 – 2565.5 MHz			

Plot 7.5.1 Peak power spectral density test results at low frequency, 40 MHz, QPSK RF#1

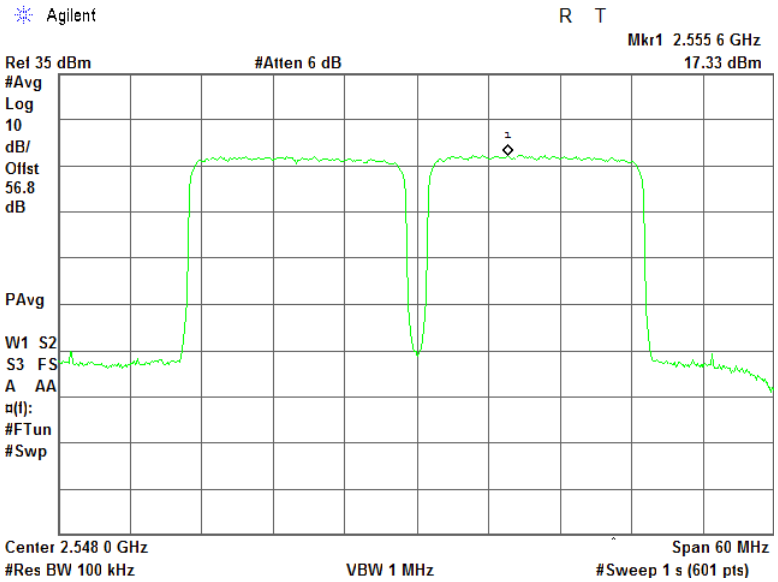


Plot 7.5.2 Peak power spectral density test results at mid frequency, 40 MHz, QPSK RF#1

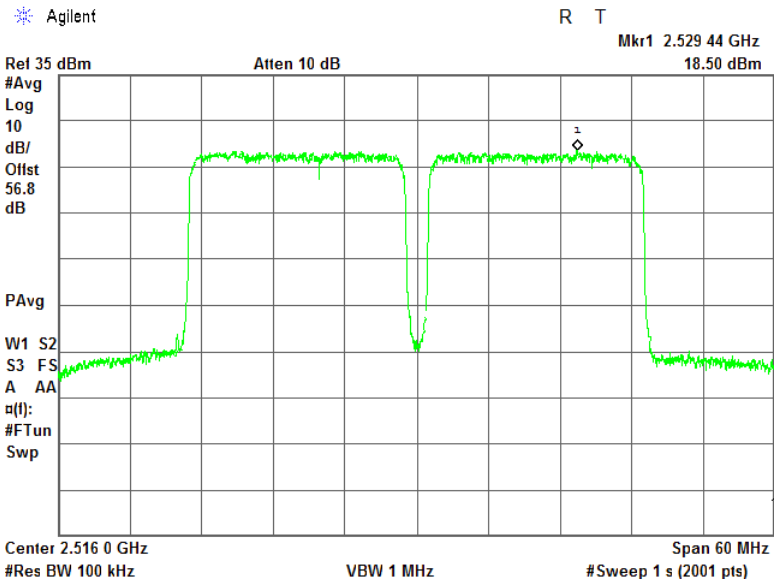


Test specification:	Section 27.50, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Feb-17 - 22-Feb-17		
Temperature: 23.1 ºC	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 120 VAC
Remarks: Operation in low band 2498.5 – 2565.5 MHz			

Plot 7.5.3 Peak power spectral density test results at high frequency, 40 MHz, QPSK RF#1

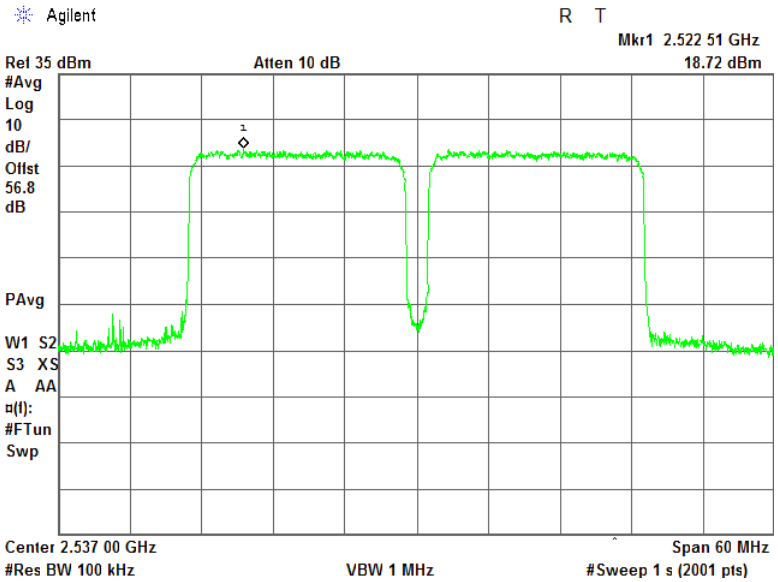


Plot 7.5.4 Peak power spectral density test results at low frequency, 40 MHz, 64QAM RF#1

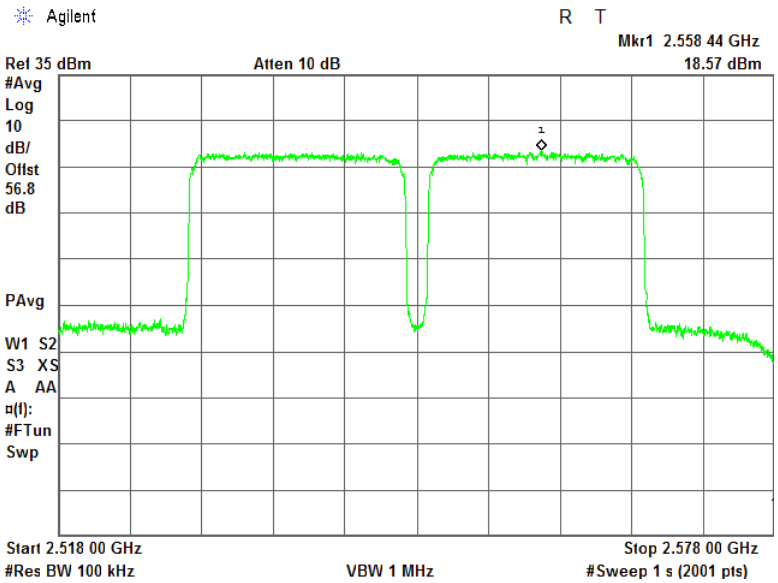


Test specification:	Section 27.50, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Feb-17 - 22-Feb-17		
Temperature: 23.1 ºC	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 120 VAC
Remarks: Operation in low band 2498.5 – 2565.5 MHz			

Plot 7.5.5 Peak power spectral density test results at mid frequency, 40 MHz, 64QAM RF#1

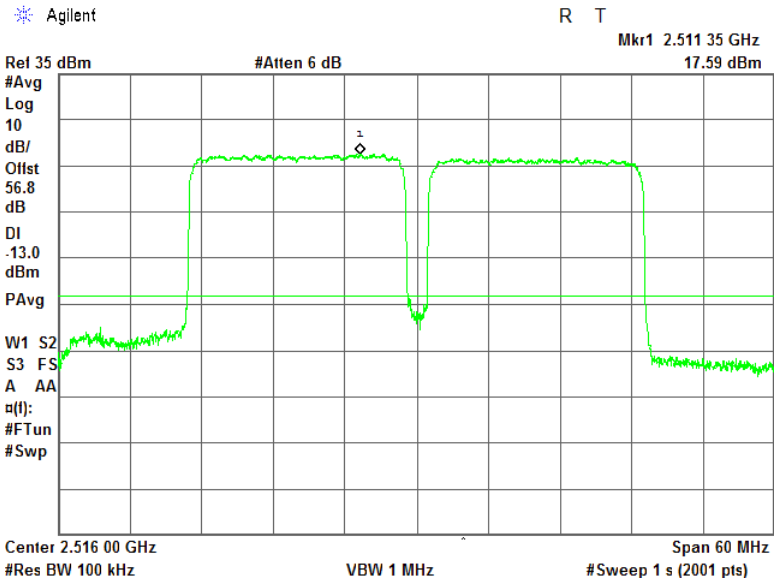


Plot 7.5.6 Peak power spectral density test results at high frequency, 40 MHz, 64QAM RF#1

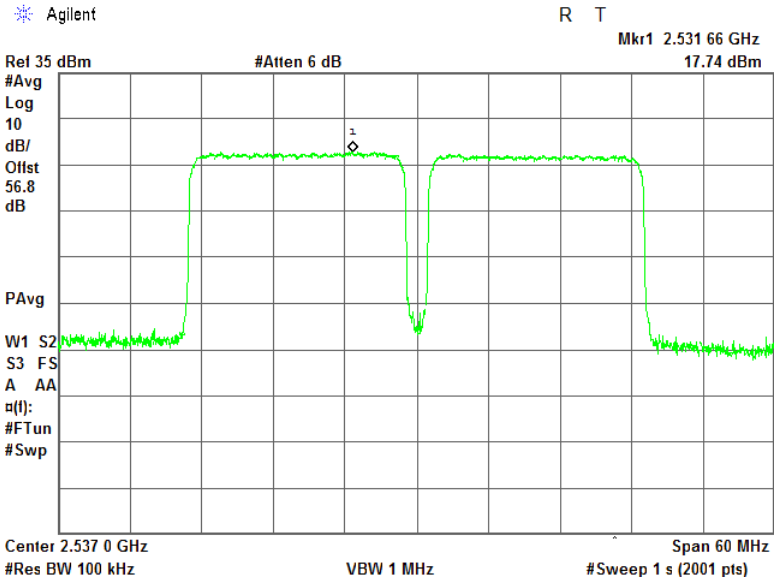


Test specification:	Section 27.50, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Feb-17 - 22-Feb-17		
Temperature: 23.1 °C	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 120 VAC
Remarks: Operation in low band 2498.5 – 2565.5 MHz			

Plot 7.5.7 Peak power spectral density test results at low frequency, 40 MHz, QPSK RF#2

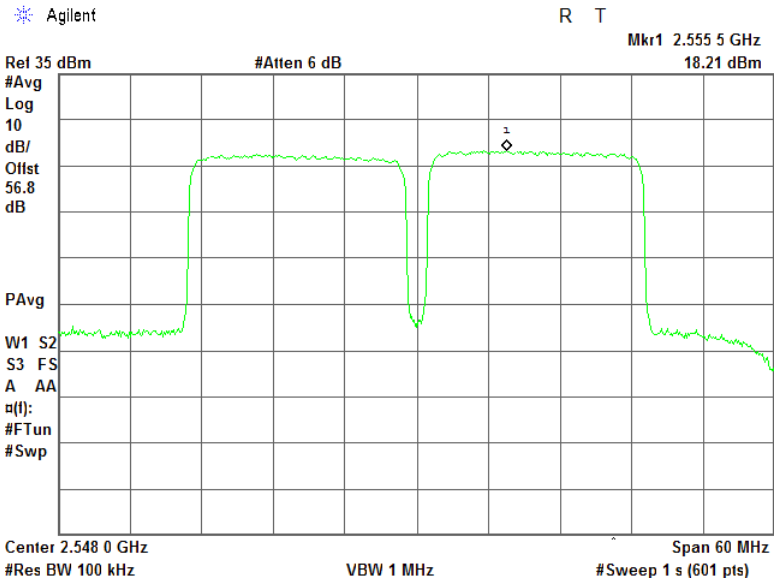


Plot 7.5.8 Peak power spectral density test results at mid frequency, 40 MHz, QPSK RF#2

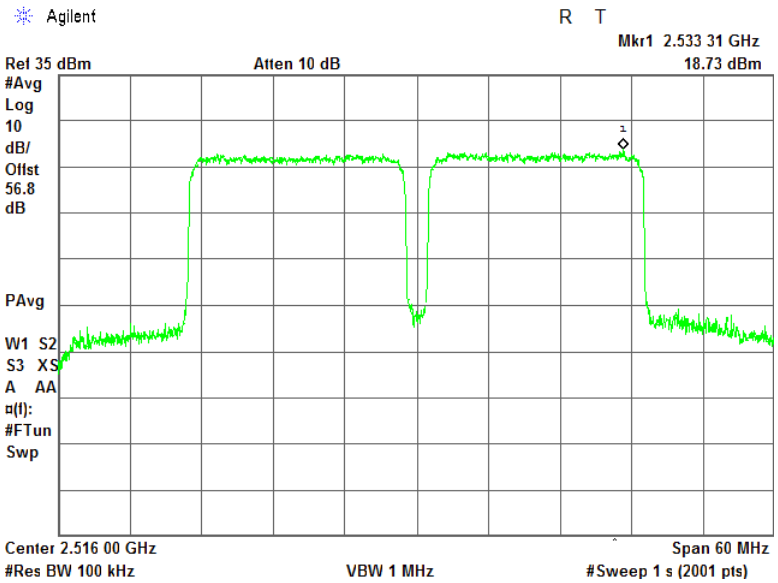


Test specification:	Section 27.50, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Feb-17 - 22-Feb-17		
Temperature: 23.1 °C	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 120 VAC
Remarks: Operation in low band 2498.5 – 2565.5 MHz			

Plot 7.5.9 Peak power spectral density test results at high frequency, 40 MHz, QPSK RF#2

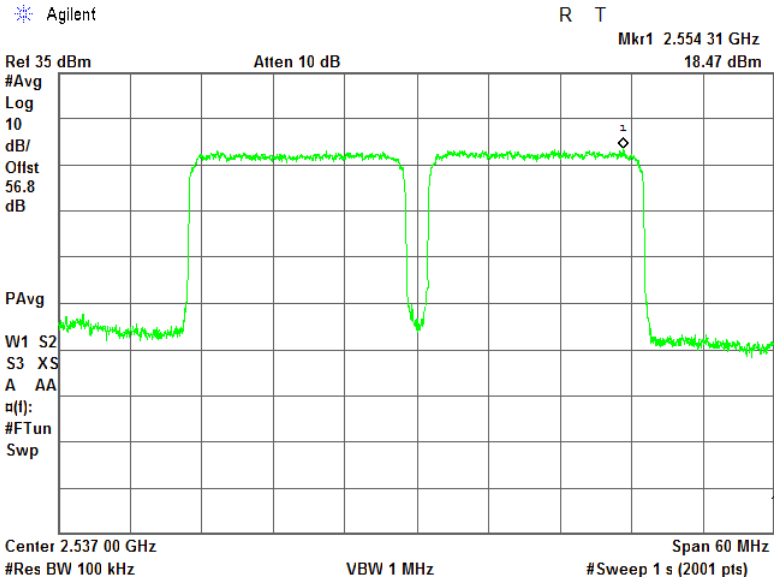


Plot 7.5.10 Peak power spectral density test results at low frequency, 40 MHz, 64QAM RF#2

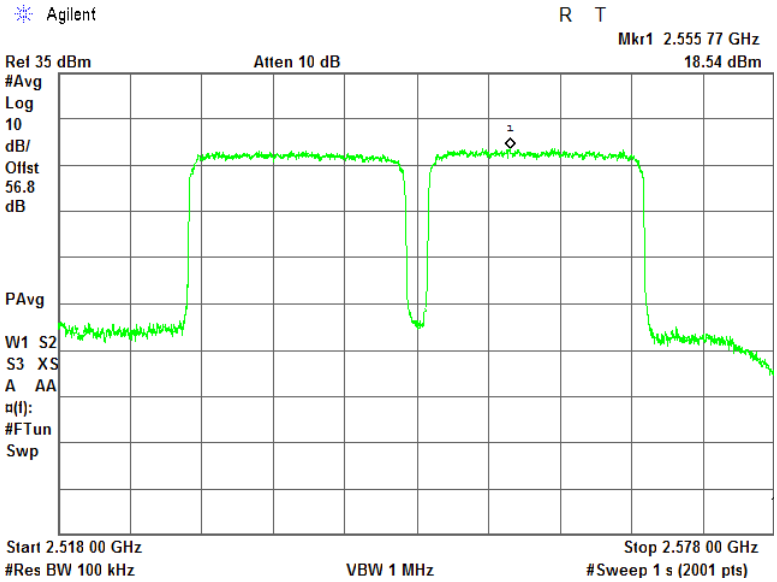


Test specification:	Section 27.50, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Feb-17 - 22-Feb-17		
Temperature: 23.1 °C	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 120 VAC
Remarks: Operation in low band 2498.5 – 2565.5 MHz			

Plot 7.5.11 Peak power spectral density test results at mid frequency, 40 MHz, 64QAM RF#2



Plot 7.5.12 Peak power spectral density test results at high frequency, 40 MHz, 64QAM RF#2



Test specification:	Section 27.50, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Feb-17		
Temperature: 23.1 ºC	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 120 VAC
Remarks: Operation in high band 2620.5 – 2687.5 MHz			

7.6 Maximum output power test in 2620.5 – 2687.5 MHz band

7.6.1 General

This test was performed to measure the peak output power at RF antenna connector. Specification test limits are given in Table 7.6.1.

Table 7.6.1 Maximum output power limits

Transmitter type	Assigned frequency range, MHz	Maximum peak output power dBm
Main, booster and base stations	2618.0 – 2690.0	63+10log(X/Y)+10log(360/beamwidth)
		Maximum peak power density dBm/100 kHz
		EIRP+10log(0.1/Y)

*- X is the actual channel width in MHz (occupied bandwidth), Y is either

1) 6 MHz if prior to transition or the station is in the MBS following transition or
2) 5.5 MHz if the station is in the LBS and UBS following transition, and
3) beamwidth is the total horizontal plane beam width of the individual transmitting antenna for the station or any sector measured at the half-power points.

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.

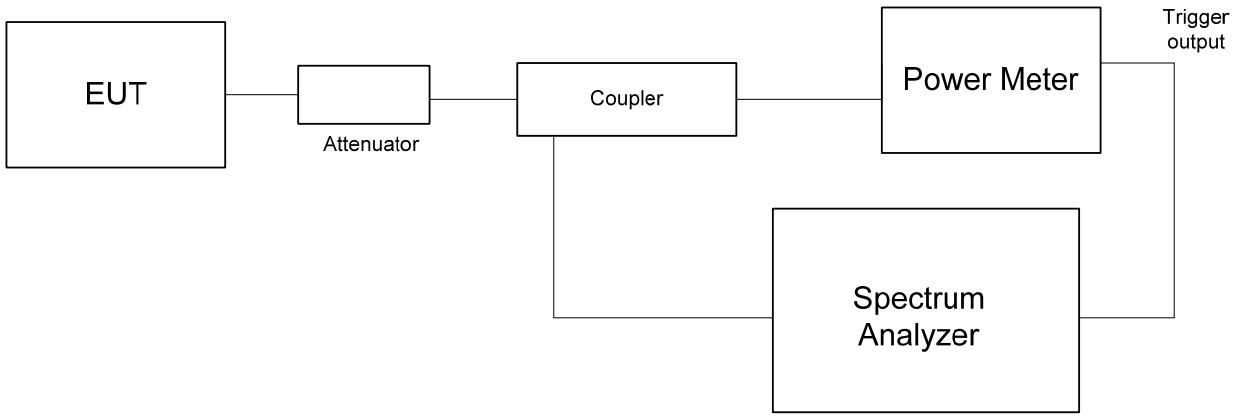
7.6.2.2 The EUT was adjusted to produce maximum available to the end user RF output power.

7.6.2.3 The average output powe was measured with power meter as provided in Table 7.6.2.

7.6.2.4 The power spectral density was measured with spectrum analyzer as provided in Table 7.6.3.

7.6.2.5 The test results are provided in the tables below and associated plots.

Figure 7.6.1 Peak output power test setup



Test specification:	**Section 27.50, Peak output power**		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	22-Feb-17		
Temperature: 23.1 ºC	**Relative Humidity:** 47 %	**Air Pressure:** 1016 hPa	**Power:** 120 VAC
Remarks: Operation in high band 2620.5 – 2687.5 MHz			

Table 7.6.2 Peak output power test results

DETECTOR USED: Average within Tx burst
DUTY CYCLE: 55%
EBW: 40 MHz

Carrier frequency, MHz	Power Meter reading RF#1, dBm	Power Meter reading RF#2, dBm	Total RF power**, dBm	Antenna gain, dBi	Total EIRP*, dBm	Limit***, dBm	Margin, dB	Verdict
QPSK								
2638.0	42.73	42.89	45.82	18.0	63.82	69.67	-5.85	Pass
2653.5	42.57	42.49	45.54	18.0	63.56	69.73	-6.18	Pass
2670.0	42.62	42.36	45.50	18.0	63.50	69.74	-6.23	Pass
64QAM								
2638.0	42.59	42.83	45.72	18.0	63.74	69.67	-5.93	Pass
2653.5	42.87	42.65	45.77	18.0	63.77	69.72	-5.95	Pass
2670.0	42.69	42.48	45.60	18.0	63.61	69.73	-6.12	Pass
QPSK								
2638.0	42.73	42.89	45.82	17.0	62.82	68.26	-5.44	Pass
2653.5	42.57	42.49	45.54	17.0	62.54	68.32	-5.78	Pass
2670.0	42.62	42.36	45.50	17.0	62.50	68.32	-5.82	Pass
64QAM								
2638.0	42.59	42.83	45.72	17.0	62.72	68.26	-5.53	Pass
2653.5	42.87	42.65	45.77	17.0	62.77	68.31	-5.54	Pass
2670.0	42.69	42.48	45.60	17.0	62.60	68.31	-5.72	Pass
QPSK								
2638.0	42.73	42.89	45.82	11.0	56.82	69.67	-12.85	Pass
2653.5	42.57	42.49	45.54	11.0	56.56	69.73	-13.18	Pass
2670.0	42.62	42.36	45.50	11.0	56.50	69.74	-13.23	Pass
64QAM								
2638.0	42.59	42.83	45.72	11.0	56.74	69.67	-12.93	Pass
2653.5	42.87	42.65	45.77	11.0	56.77	69.72	-12.95	Pass
2670.0	42.69	42.48	45.60	11.0	56.61	69.73	-13.12	Pass

* - EIRP total, dBm = Total RF power**, dBm + Antenna Gain, dBi
** - Total RF power , dBm = 10*log(10^(Power RF#1 /10) + 10^(Power RF#2 /10))
*** - See Table 7.6.5.

Reference numbers of test equipment used

HL 2214	HL 3301	HL 3302					

Full description is given in Appendix A.

Test specification:	**Section 27.50, Peak output power**		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	22-Feb-17		
Temperature: 23.1 ºC	**Relative Humidity:** 47 %	**Air Pressure:** 1016 hPa	**Power:** 120 VAC
Remarks: Operation in high band 2620.5 – 2687.5 MHz			

Table 7.6.3 Power spectral density test results

DETECTOR USED: Average gated
RESOLUTION BANDWIDTH: 100 kHz
VIDEO BANDWIDTH: 300 kHz
CHANNEL BANDWIDTH: 40 MHz
DUTY CYCLE: 55%
NUMBER OUTPUTS: N=2

Carrier frequency, MHz	SA reading*, RF #1 or RF#2 dBm/100kHz	Total PSD dBm/100kHz	Antenna gain, dBi	Total EIRP PSD**, dBm/100kHz	Limit***, dBm	Margin, dB	Verdict
QPSK							
2638.0	18.61	21.61	18.0	39.61	43.19	-3.58	Pass
2653.5	18.75	21.75	18.0	39.75	43.30	-3.55	Pass
2670.0	18.76	21.76	18.0	39.76	43.30	-3.54	Pass
64 QAM							
2638.0	18.73	21.73	18.0	39.73	43.19	-3.46	Pass
2653.5	18.88	21.88	18.0	39.88	43.29	-3.41	Pass
2670.0	18.99	21.99	18.0	39.99	43.29	-3.30	Pass
QPSK							
2638.0	18.61	21.61	17.0	38.61	41.78	-3.17	Pass
2653.5	18.75	21.75	17.0	38.77	41.89	-3.12	Pass
2670.0	18.76	21.76	17.0	38.76	41.89	-3.13	Pass
64 QAM							
2638.0	18.73	21.73	17.0	38.75	41.77	-3.03	Pass
2653.5	18.88	21.88	17.0	38.88	41.88	-2.99	Pass
2670.0	18.99	21.99	17.0	39.01	41.88	-2.87	Pass
QPSK							
2638.0	18.61	21.61	11.0	32.61	43.19	-10.58	Pass
2653.5	18.75	21.75	11.0	32.75	43.30	-10.55	Pass
2670.0	18.76	21.76	11.0	32.76	43.30	-10.54	Pass
64 QAM							
2638.0	18.73	21.73	11.0	32.73	43.19	-10.46	Pass
2653.5	18.88	21.88	11.0	32.88	43.29	-10.41	Pass
2670.0	18.99	21.99	11.0	32.99	43.29	-10.30	Pass

* SA reading including attenuation, cable loss and Duty Cycle correction factor
** Total EIRP PSD, dBm/100kHz = SA reading Max (dBm/100kHz,RF#1or RF#2)+ 3 dB + Antenna Gain, dBi
*** See Table 7.6.6.

Reference numbers of test equipment used

HL 2214	HL 3301	HL 3302	HL 3818	HL 3901			

Full description is given in Appendix A.

Test specification:	Section 27.50, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Feb-17		
Temperature: 23.1 ºC	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 120 VAC
Remarks: Operation in high band 2620.5 – 2687.5 MHz			

Table 7.6.4 Post - transition frequency channels assignment

Channel	OBW, MHz	Peak power limit, dBm	Power density limit, dBm/100kHz
40 MHz 4 Channels QPSK 46.4 Mbps			
2638.0 MHz BRS Ch2A+BRS/EBS E1+E2+E3+F1+F2+F3+BRS H1	37.354	63+10log(OBW/44.5)+ 10log(360/beamwidth)	EIRP+10log(0.1/22.5)
2653.5 MHz BRS/EBS E1+E2+E3+F1+F2+F3+BRS H1+H2+H3	37.453	63+10log(OBW/44.0)+ 10log(360/beamwidth)	EIRP+10log(0.1/24.0)
2670 MHz BRS/EBS F2+F3+BRS H1+H2+H3+EBS G1+G2+G3	37.466	63+10log(OBW/44.0)+ 10log(360/beamwidth)	EIRP+10log(0.1/22.0)
40 MHz 4 Channels 64QAM 190 Mbps			
2638.0 MHz BRS Ch2A+BRS/EBS E1+E2+E3+F1+F2+F3+BRS H1	37.315	63+10log(OBW/44.5)+ 10log(360/beamwidth)	EIRP+10log(0.1/22.5)
2653.5 MHz BRS/EBS E1+E2+E3+F1+F2+F3+BRS H1+H2+H3	37.356	63+10log(OBW/44.0)+ 10log(360/beamwidth)	EIRP+10log(0.1/24.0)
2670 MHz BRS/EBS F2+F3+BRS H1+H2+H3+EBS G1+G2+G3	37.394	63+10log(OBW/44.0)+ 10log(360/beamwidth)	EIRP+10log(0.1/22.0)

Table 7.6.5 EIRP limits

Channel	Channel BW, MHz	Peak power limit, dBm	
		17 dBi, 90º beamwidth	18 dBi, 65ºbeamwidth 11 dBi, 65ºbeamwidth
40 MHz Dual Channel QPSK			
2638.0 MHz BRS Ch2A+BRS/EBS E1+E2+E3+F1+F2+F3+BRS H1	44.5	68.26	69.67
2653.5 MHz BRS/EBS E1+E2+E3+F1+F2+F3+BRS H1+H2+H3	44	68.32	69.73
2670 MHz BRS/EBS F2+F3+BRS H1+H2+H3+EBS G1+G2+G3	44	68.32	69.74
40 MHz Dual Channel 64 QAM			
2638.0 MHz BRS Ch2A+BRS/EBS E1+E2+E3+F1+F2+F3+BRS H1	44.5	68.26	69.67
2653.5 MHz BRS/EBS E1+E2+E3+F1+F2+F3+BRS H1+H2+H3	44	68.31	69.72
2670 MHz BRS/EBS F2+F3+BRS H1+H2+H3+EBS G1+G2+G3	44	68.31	69.73

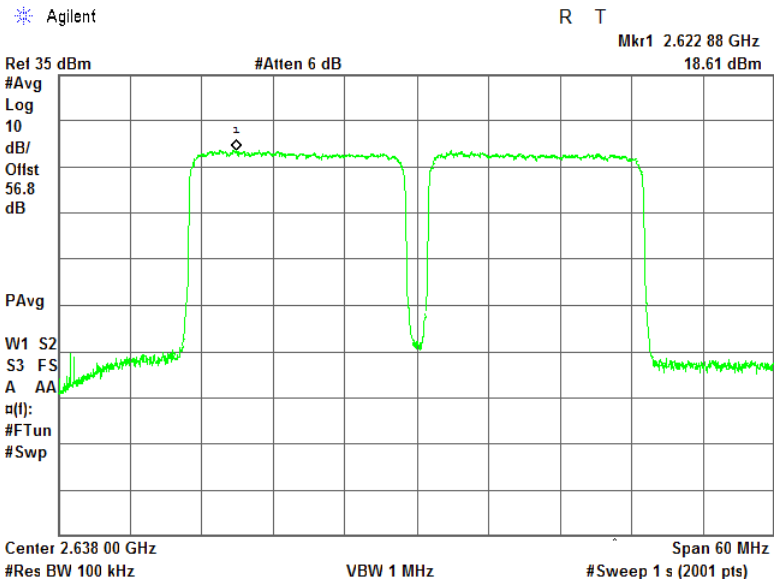
Test specification:	Section 27.50, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Feb-17		
Temperature: 23.1 ºC	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 120 VAC
Remarks: Operation in high band 2620.5 – 2687.5 MHz			

Table 7.6.6 Peak power spectral density limits

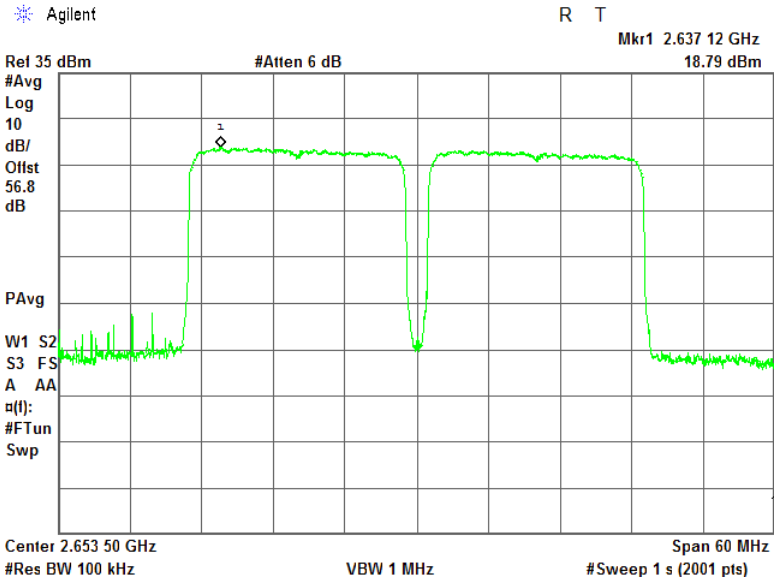
Channel	Channel BW, MHz	Peak power density, dBm/100kHz	
		17 dBi, 90º beamwidth	18 dBi, 65ºbeamwidth 11 dBi, 65ºbeamwidth
40 MHz Dual Channel QPSK			
2638.0 MHz BRS Ch2A+BRS/EBS E1+E2+E3+F1+F2+F3+BRS H1	44.5	41.78	43.19
2653.5 MHz BRS/EBS E2+E3+F1+F2+F3+BRS H1+H2+H3	44	41.89	43.30
2670 MHz BRS/EBS F2+F3+BRS H1+H2+H3+EBS G1+G2+G3	44	41.89	43.30
40 MHz Dual Channel 64 QAM			
2638.0 MHz BRS Ch2A+BRS/EBS E1+E2+E3+F1+F2+F3+BRS H1	44.5	41.77	43.19
2653.5 MHz BRS/EBS E2+E3+F1+F2+F3+BRS H1+H2+H3	44	41.88	43.29
2670 MHz BRS/EBS F2+F3+BRS H1+H2+H3+EBS G1+G2+G3	44	41.88	43.29

Test specification:	**Section 27.50, Peak output power**		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	22-Feb-17		
Temperature: 23.1 ºC	**Relative Humidity:** 47 %	**Air Pressure:** 1016 hPa	**Power:** 120 VAC
Remarks: Operation in high band 2620.5 – 2687.5 MHz			

Plot 7.6.1 Peak power spectral density test results at low frequency, 40 MHz, QPSK RF#1

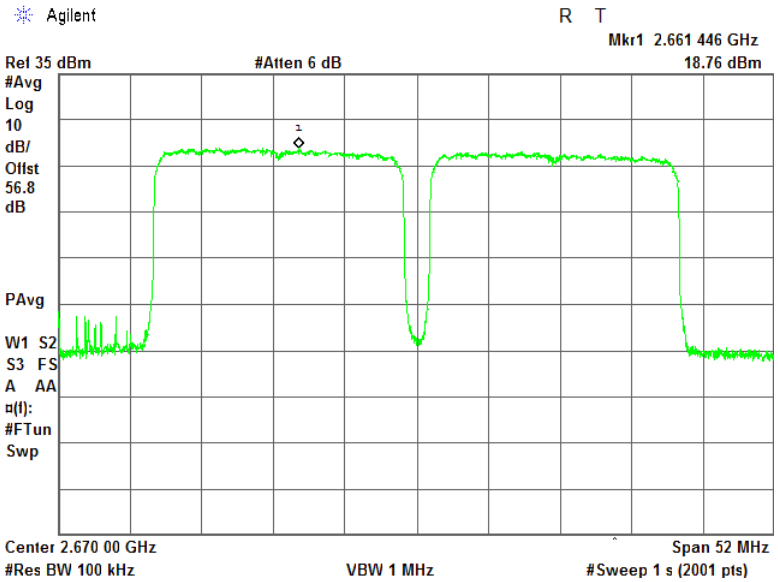


Plot 7.6.2 Peak power spectral density test results at mid frequency, 40 MHz, QPSK RF#1

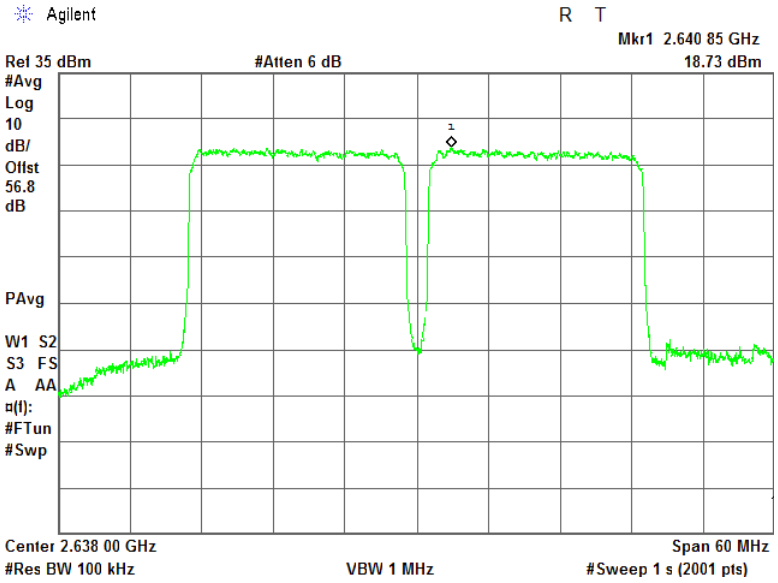


Test specification:	Section 27.50, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Feb-17		
Temperature: 23.1 °C	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 120 VAC
Remarks: Operation in high band 2620.5 – 2687.5 MHz			

Plot 7.6.3 Peak power spectral density test results at high frequency, 40 MHz, QPSK RF#1

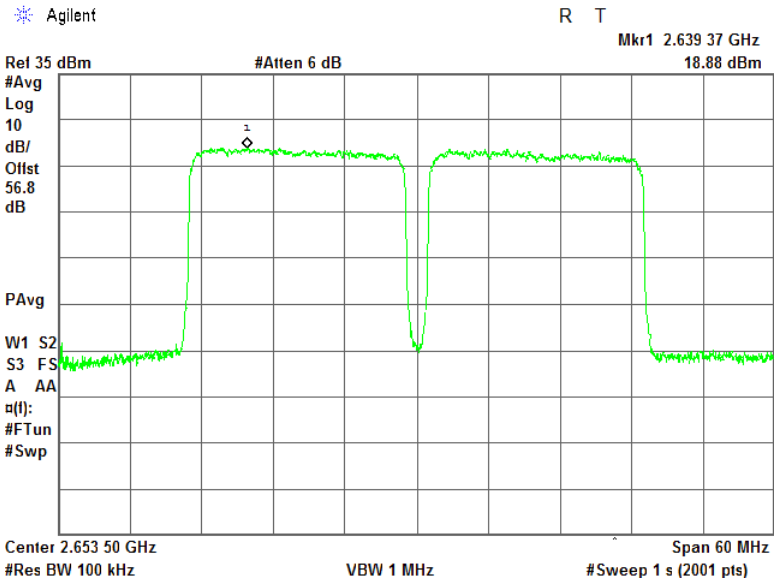


Plot 7.6.4 Peak power spectral density test results at low frequency, 40 MHz, 64QAM RF#1

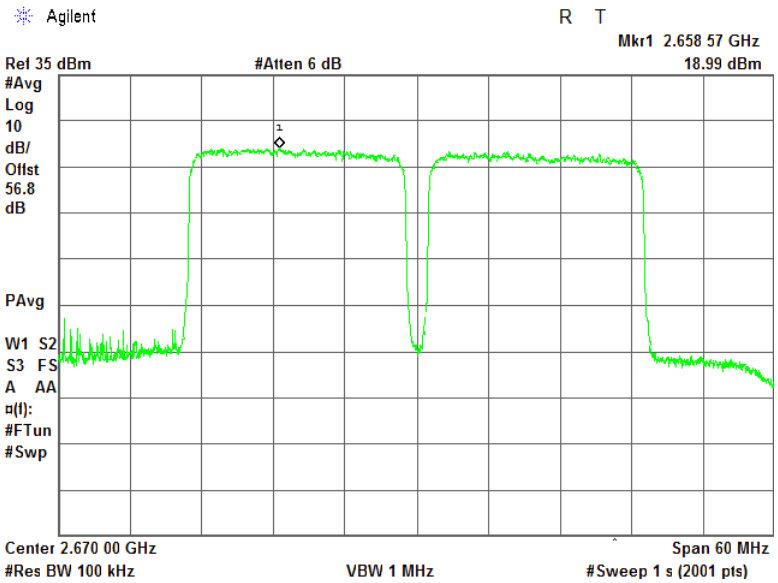


Test specification:	Section 27.50, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Feb-17		
Temperature: 23.1 °C	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 120 VAC
Remarks: Operation in high band 2620.5 – 2687.5 MHz			

Plot 7.6.5 Peak power spectral density test results at mid frequency, 40 MHz, 64QAM RF#1

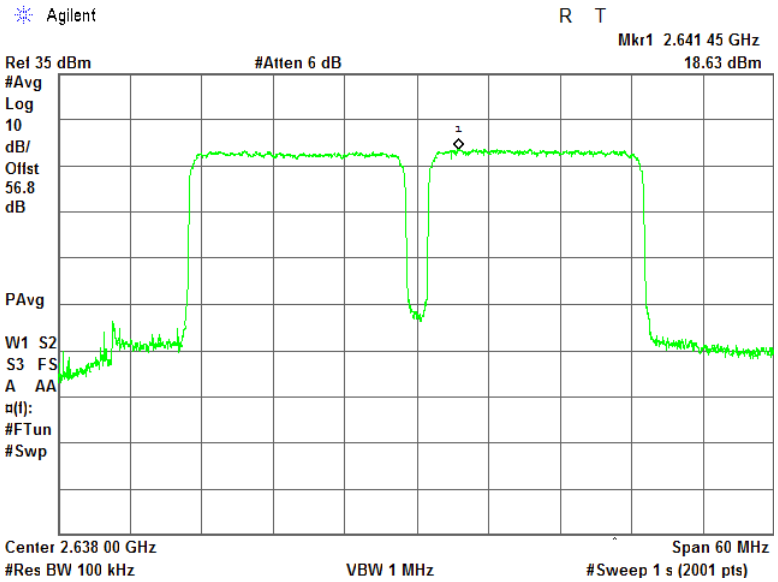


Plot 7.6.6 Peak power spectral density test results at high frequency, 40 MHz, 64QAM RF#1

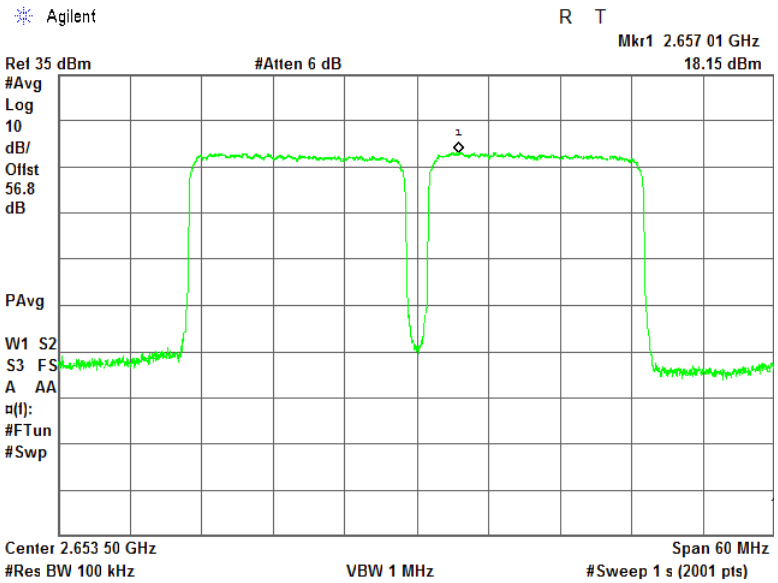


Test specification:	Section 27.50, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Feb-17		
Temperature: 23.1 ºC	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 120 VAC
Remarks: Operation in high band 2620.5 – 2687.5 MHz			

Plot 7.6.7 Peak power spectral density test results at low frequency, 40 MHz, QPSK RF#2

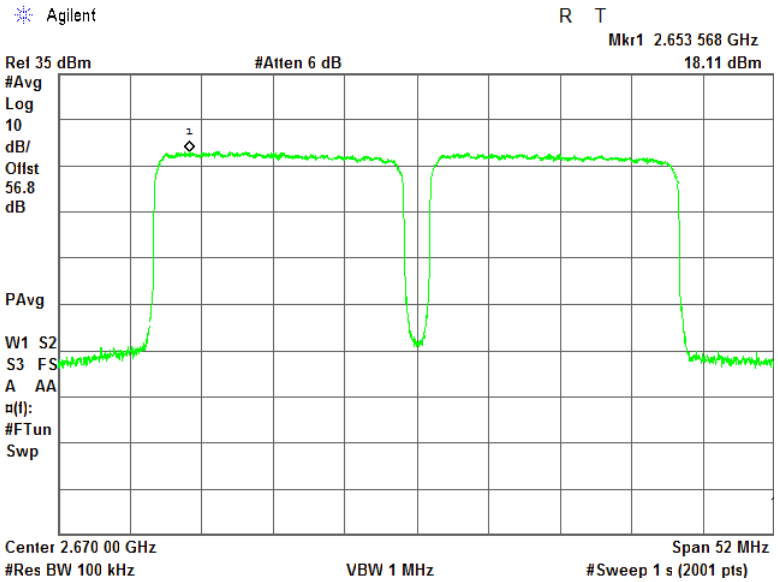


Plot 7.6.8 Peak power spectral density test results at mid frequency, 40 MHz, QPSK RF#2

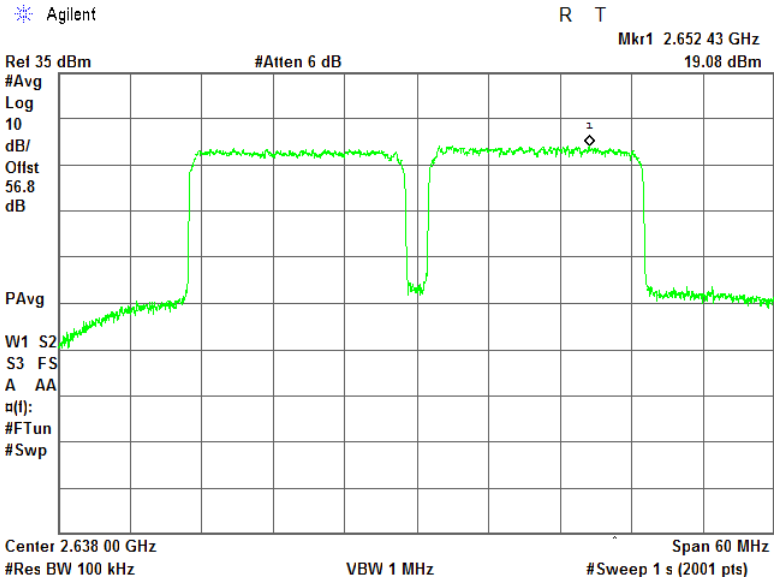


Test specification:	Section 27.50, Peak output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Feb-17		
Temperature: 23.1 °C	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 120 VAC
Remarks: Operation in high band 2620.5 – 2687.5 MHz			

Plot 7.6.9 Peak power spectral density test results at high frequency, 40 MHz, QPSK RF#2

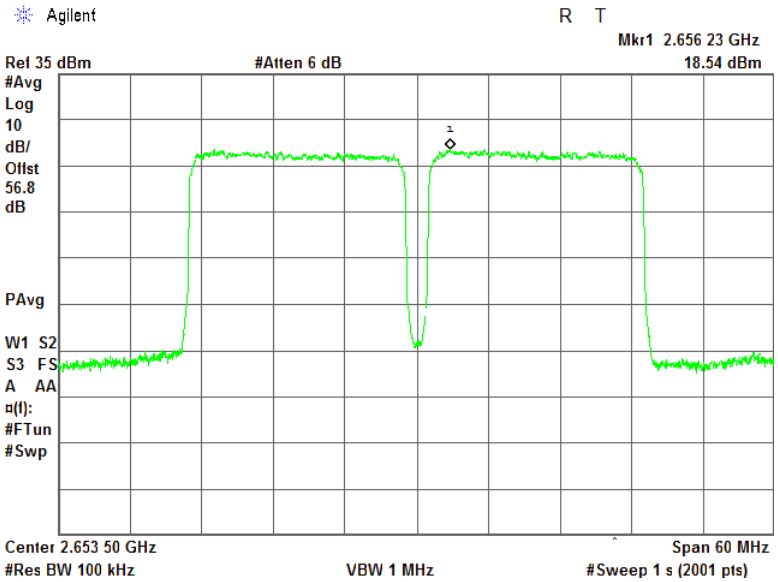


Plot 7.6.10 Peak power spectral density test results at low frequency, 40 MHz, 64QAM RF#2

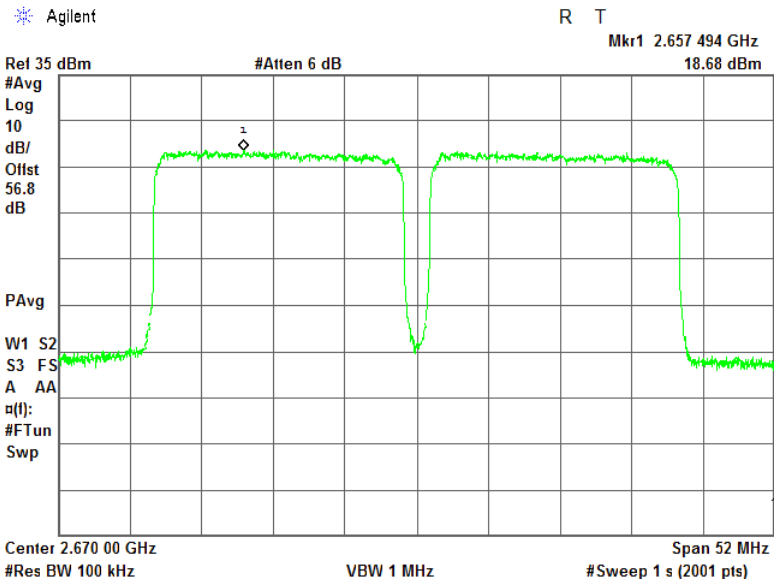


Test specification:	**Section 27.50, Peak output power**		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	22-Feb-17		
Temperature: 23.1 ºC	**Relative Humidity:** 47 %	**Air Pressure:** 1016 hPa	**Power:** 120 VAC
Remarks: Operation in high band 2620.5 – 2687.5 MHz			

Plot 7.6.11 Peak power spectral density test results at mid frequency, 40 MHz, 64QAM RF#2



Plot 7.6.12 Peak power spectral density test results at high frequency, 40 MHz, 64QAM RF#2



Test specification:	Section 27.53, Band edge emissions		
Test procedure:	47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	20-Feb-17 - 21-Feb-17		
Temperature: 23.2 ºC	Relative Humidity: 48 %	Air Pressure: 1019 hPa	Power: 120 VAC
Remarks: Operation in full band 2498.5-2687.5 MHz			

7.7 Band edge emissions at RF connector test in 2498.5-2687.5 MHz band

7.7.1 General

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

Table 7.7.1 Spurious emission limits at band edges

Channel	Frequency range	Attenuation below carrier, dBc	Limit, dBm
Channel bandwidth 40 MHz			
2516.0	2496.0 – 2536.0	43+ 10*Log (P*)	-13.0
2594.0	2572.0 – 2614.0	43+ 10*Log (P*)	-13.0
2670.0	2646.0 – 2690.0	43+ 10*Log (P*)	-13.0

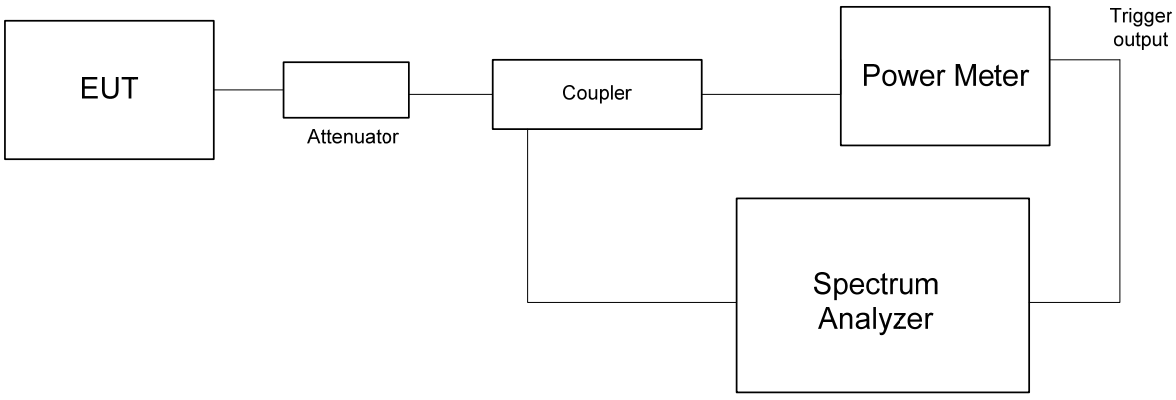
* - P is transmitter output power in Watts

7.7.2 Test procedure

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

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

Figure 7.7.1 Spurious emission test setup for single output



Test specification:	**Section 27.53, Band edge emissions**		
Test procedure:	47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	20-Feb-17 - 21-Feb-17		
Temperature: 23.2 ºC	**Relative Humidity:** 48 %	**Air Pressure:** 1019 hPa	**Power:** 120 VAC
Remarks: Operation in full band 2498.5-2687.5 MHz			

Table 7.7.2 Spurious emission at the low band edge test results

DETECTOR USED: Average
VIDEO BANDWIDTH: ≥ Resolution bandwidth
EBW: 40 MHz
NUMBER OF OUTPUTS: N=2

Frequency MHz	Frequency offset, ± MHz	Low band edge, dBm	RBW, kHz	Integration BW, kHz	Total low band edge*, dBm	Limit, dBm	Verdict
QPSK							
2516.0	20.0	-17.51	300	1000	-14.51	-13.0	Pass
	21.5	-18.36	300	1000	-15.36	-13.0	
2594.0	22.5	-16.96	300	1000	-13.96	-13.0	Pass
	23.5	-16.97	300	1000	-13.97	-13.0	
2670.0	24.5	-18.55	300	1000	-15.55	-13.0	Pass
	25.5	-19.23	300	1000	-16.23	-13.0	
64QAM							
2516.0	20.0	-16.40	390	NA	-13.40	-13.0	Pass
	21.5	-16.54	300	1000	-13.54	-13.0	
2594.0	22.5	-18.38	300	1000	-15.38	-13.0	Pass
	23.5	-18.70	300	1000	-15.70	-13.0	
2670.0	24.5	-18.99	390	NA	-15.99	-13.0	Pass
	25.5	-19.67	300	1000	-16.67	-13.0	

* - Total low band edge = Low Band Edge + 10log(N)

Table 7.7.3 Spurious emission at the high band edge test results

DETECTOR USED: Average
VIDEO BANDWIDTH: ≥ Resolution bandwidth
EBW: 40MHz
NUMBER OF OUTPUTS: N=2

Frequency MHz	Frequency offset, ± MHz	High band edge, dBm	RBW, kHz	Integration BW, kHz	Total high band edge*, dBm	Limit, dBm	Verdict
QPSK							
2516.0	20.5	-18.13	300	1000	-15.13	-13.0	Pass
	21.5	-18.48	300	1000	-15.48	-13.0	
2594.0	20.5	-19.29	300	1000	-16.29	-13.0	Pass
	21.5	-19.78	300	1000	-16.78	-13.0	
2670.0	20.5	-18.51	300	1000	-15.51	-13.0	Pass
	21.5	-18.69	300	1000	-15.69	-13.0	
64QAM							
2516.0	20.5	-16.47	300	1000	-13.47	-13.0	Pass
	21.5	-16.41	300	1000	-13.41	-13.0	
2594.0	20.5	-19.18	300	1000	-16.18	-13.0	Pass
	21.5	-19.37	300	1000	-16.37	-13.0	
2670.0	20.5	-19.00	390	NA	-16.00	-13.0	Pass
	21.5	-18.85	300	1000	-15.85	-13.0	

* - Total high band edge = High Band Edge + 10log(N)

Reference numbers of test equipment used

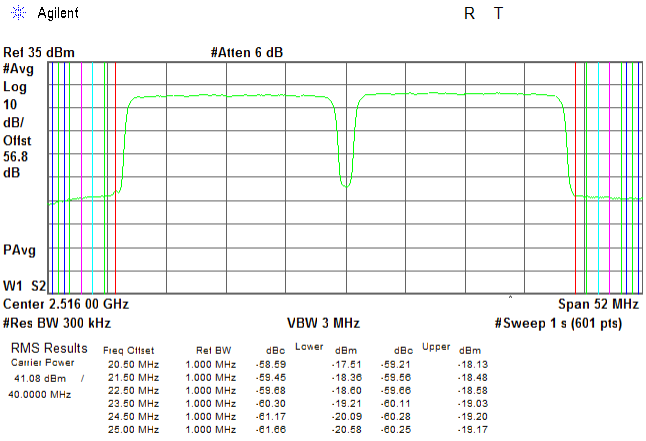
HL 2214	HL 3301	HL 3302	HL 3818	HL 4575			

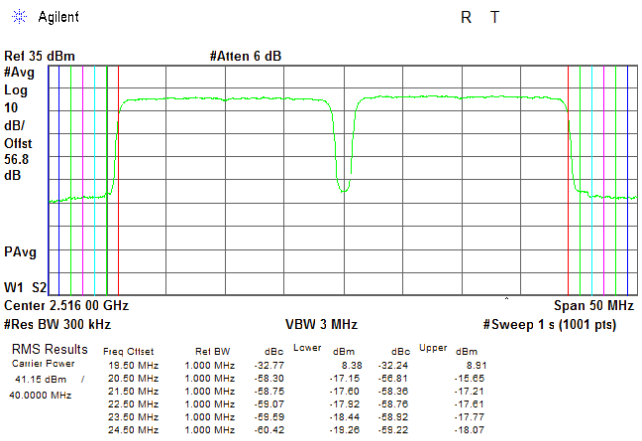
Full description is given in Appendix A.

Test specification:	**Section 27.53, Band edge emissions**		
Test procedure:	47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	20-Feb-17 - 21-Feb-17		
Temperature: 23.2 ºC	**Relative Humidity:** 48 %	**Air Pressure:** 1019 hPa	**Power:** 120 VAC
Remarks: Operation in full band 2498.5-2687.5 MHz			

Plot 7.7.1 Spurious emission at band edges test results at low carrier frequency, 40 MHz EBW

DETECTOR USED:	Average
MODULATION:	QPSK
MODULATING SIGNAL:	PRBS
BIT RATE:	46.8 Mbps

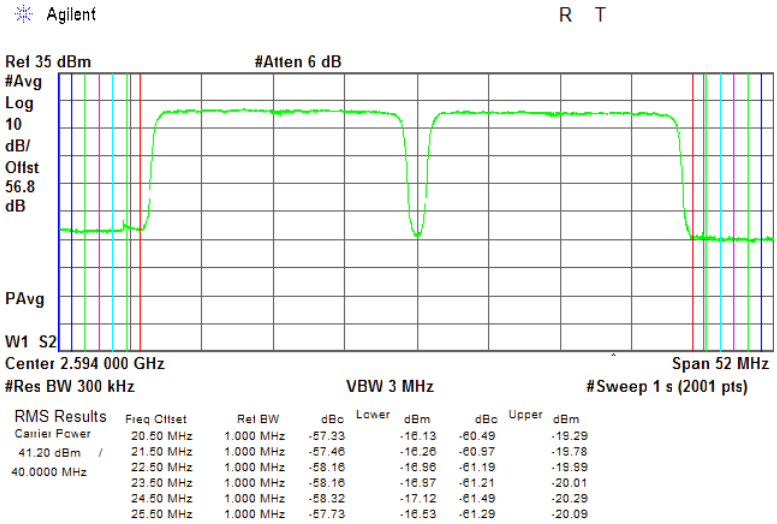




Test specification:	Section 27.53, Band edge emissions		
Test procedure:	47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	20-Feb-17 - 21-Feb-17		
Temperature: 23.2 °C	Relative Humidity: 48 %	Air Pressure: 1019 hPa	Power: 120 VAC
Remarks: Operation in full band 2498.5-2687.5 MHz			

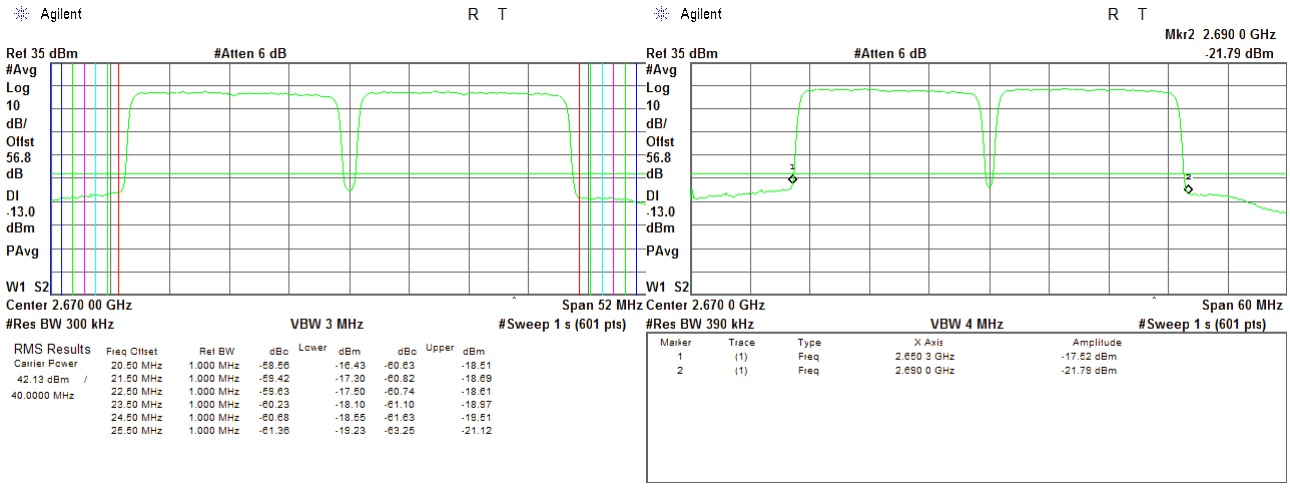
Plot 7.7.2 Spurious emission at band edges test results at mid carrier frequency, 40 MHz EBW

DETECTOR USED: Average
MODULATION: QPSK
MODULATING SIGNAL: PRBS
BIT RATE: 46.8 Mbps



Plot 7.7.3 Spurious emission at band edges test results at high carrier frequency, 40 MHz EBW

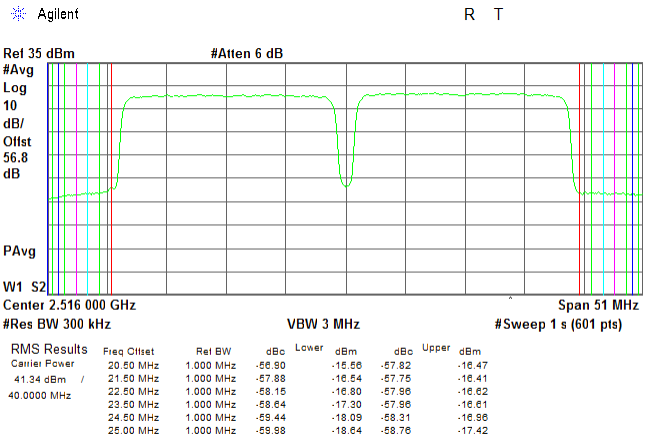
DETECTOR USED: Average
MODULATION: QPSK
MODULATING SIGNAL: PRBS
BIT RATE: 46.8 Mbps

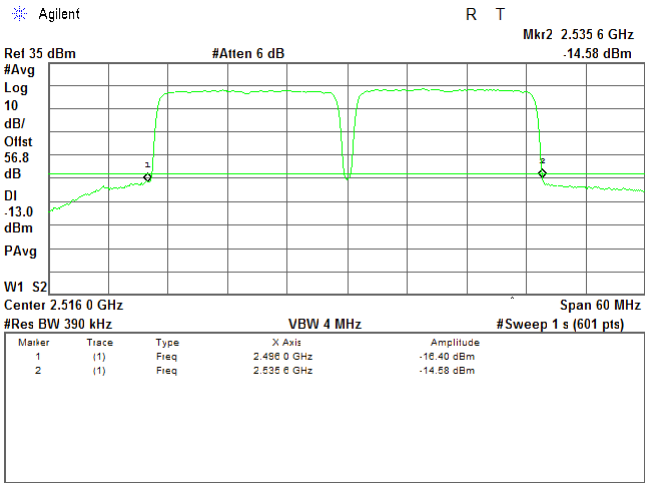


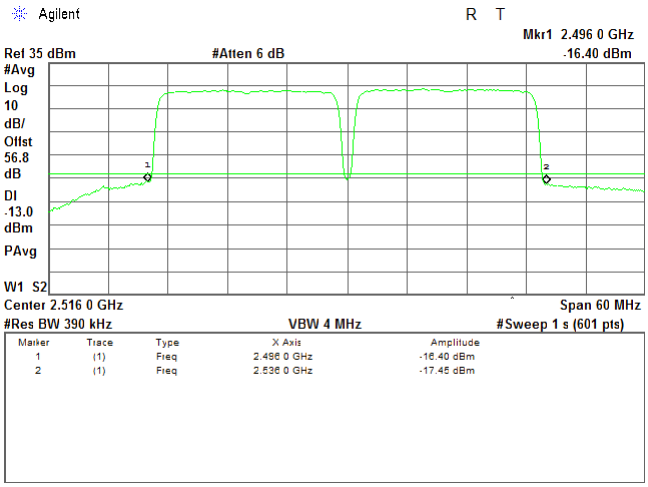
Test specification:	**Section 27.53, Band edge emissions**		
Test procedure:	47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	20-Feb-17 - 21-Feb-17		
Temperature: 23.2 °C	**Relative Humidity:** 48 %	**Air Pressure:** 1019 hPa	**Power:** 120 VAC
Remarks: Operation in full band 2498.5-2687.5 MHz			

Plot 7.7.4 Spurious emission at band edges test results at low carrier frequency, 40 MHz EBW

DETECTOR USED: Average
MODULATION: 64QAM
MODULATING SIGNAL: PRBS
BIT RATE: 190 Mbps



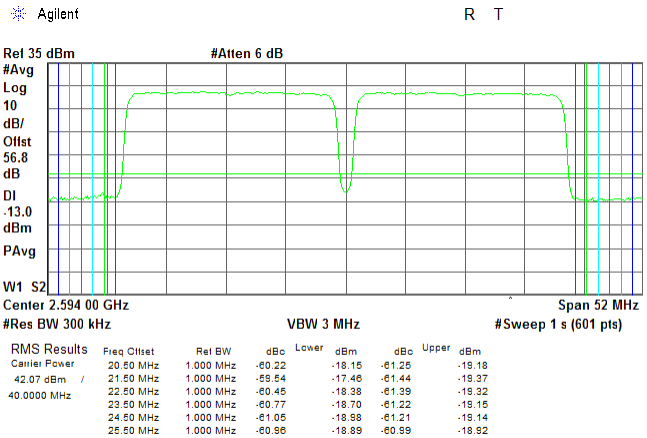


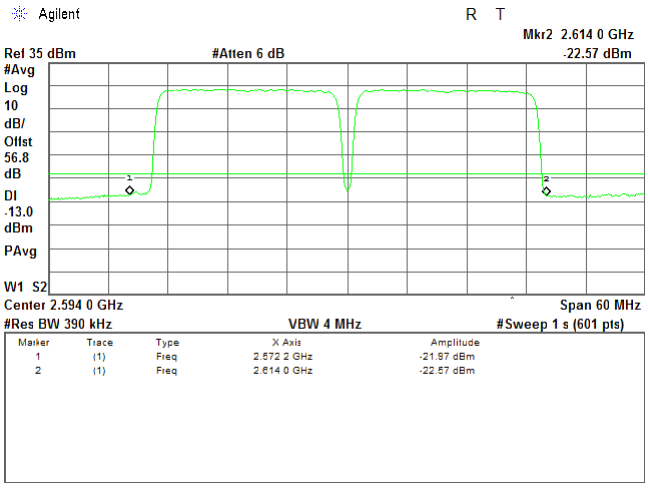


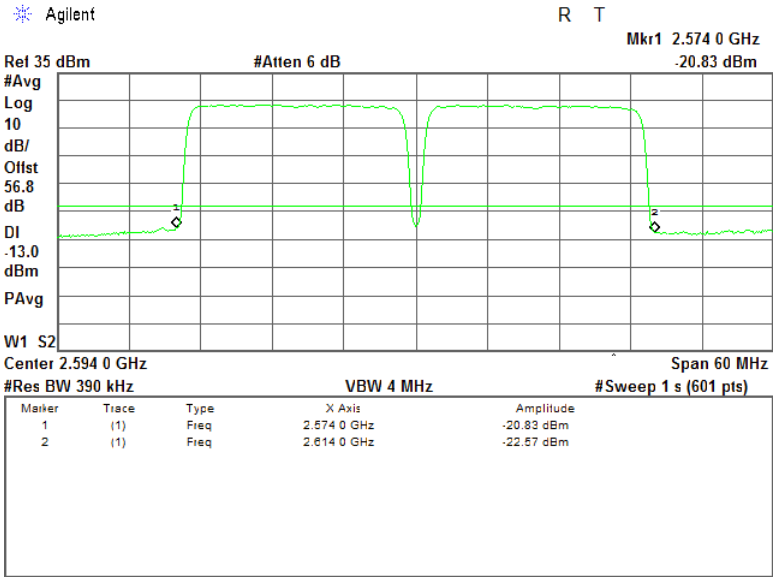
Test specification:	Section 27.53, Band edge emissions		
Test procedure:	47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	20-Feb-17 - 21-Feb-17		
Temperature: 23.2 °C	Relative Humidity: 48 %	Air Pressure: 1019 hPa	Power: 120 VAC
Remarks: Operation in full band 2498.5-2687.5 MHz			

Plot 7.7.5 Spurious emission at band edges test results at mid carrier frequency, 40 MHz EBW

DETECTOR USED: Average
MODULATION: 64QAM
MODULATING SIGNAL: PRBS
BIT RATE: 190 Mbps



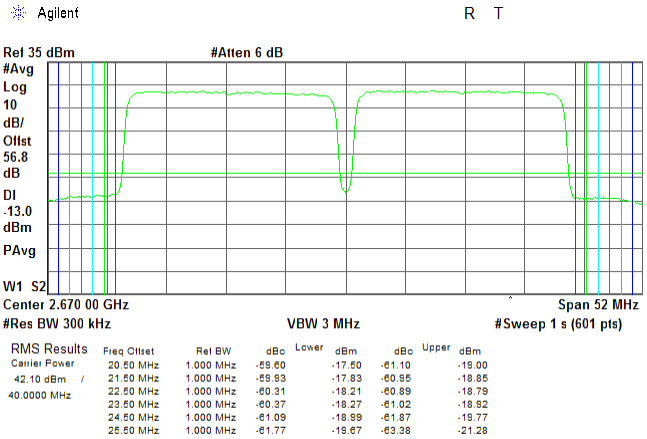


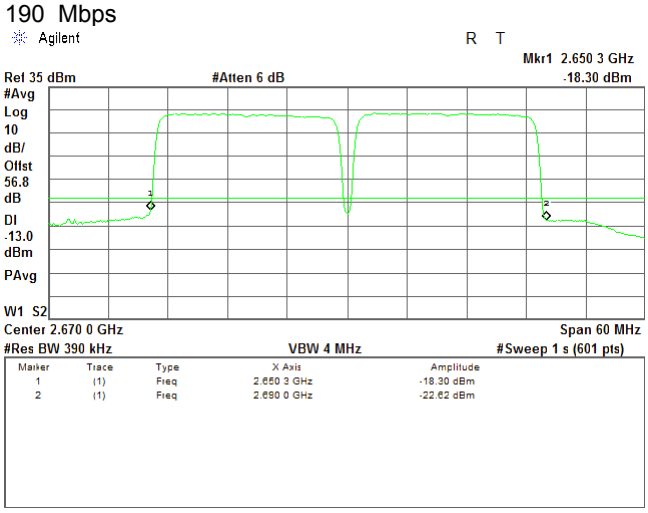


Test specification:	**Section 27.53, Band edge emissions**		
Test procedure:	47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	20-Feb-17 - 21-Feb-17		
Temperature: 23.2 °C	**Relative Humidity:** 48 %	**Air Pressure:** 1019 hPa	**Power:** 120 VAC
Remarks: Operation in full band 2498.5-2687.5 MHz			

Plot 7.7.6 Spurious emission at band edges test results at high carrier frequency, 40 MHz EBW

DETECTOR USED: Average
MODULATION: 64QAM
MODULATING SIGNAL: PRBS
BIT RATE: 190 Mbps





Test specification:	Section 27.53, Band edge emissions		
Test procedure:	47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Feb-17 - 22- Feb-17		
Temperature: 23.1 ºC	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 120 VAC
Remarks: Operation in low band 2498.5 – 2565.5 MHz			

7.8 Band edge emissions at RF connector test in 2498.5-2565.5 MHz band

7.8.1 General

This test was performed to measure spurious emissions at the channel edge at the RF antenna connector. Specification test limits are given in Table 7.8.1

Table 7.8.1 Spurious emission limits at band edges

Channel	Frequency range	Attenuation below carrier, dBc	Limit, dBm
Channel bandwidth 40 MHz			
2516.0	2496.0 – 2536.0	43+ 10*Log (P*)	-13.0
2537.0	2513.0 – 2557.0	43+ 10*Log (P*)	-13.0
2548.0	2524.0 – 2568.0	43+ 10*Log (P*)	-13.0

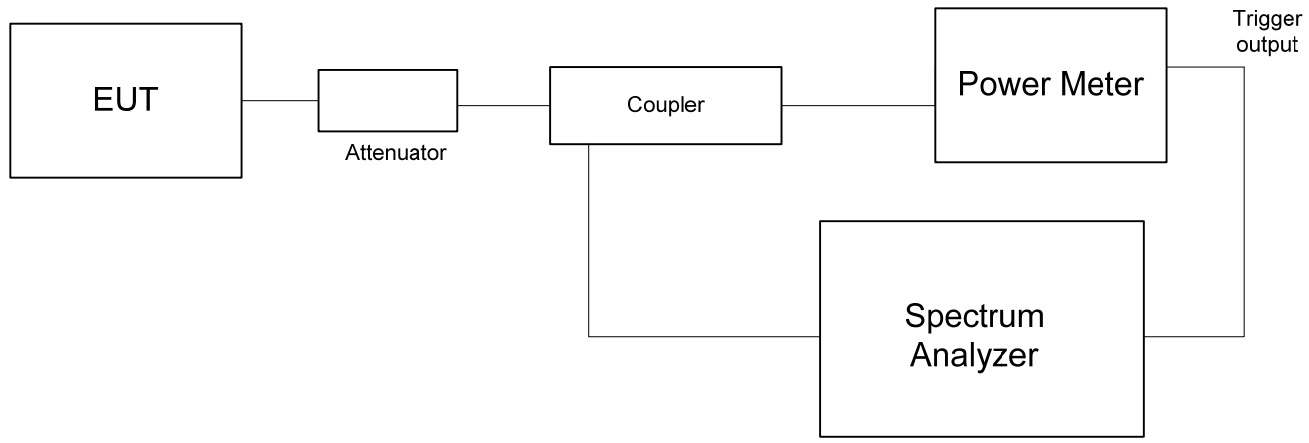
* - P is transmitter output power in Watts

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 spurious emission was measured with spectrum analyzer as provided in Table 7.8.2, Table 7.8.3 and the associated plots.

Figure 7.8.1 Spurious emission test setup for single output



Test specification:	**Section 27.53, Band edge emissions**		
Test procedure:	47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	21-Feb-17 - 22- Feb-17		
Temperature: 23.1 ºC	**Relative Humidity:** 47 %	**Air Pressure:** 1016 hPa	**Power:** 120 VAC
Remarks: Operation in low band 2498.5 – 2565.5 MHz			

Table 7.8.2 Spurious emission at the low band edge test results

DETECTOR USED: Average
VIDEO BANDWIDTH: ≥ Resolution bandwidth
EBW: 40 MHz
NUMBER OF OUTPUTS: N=2

Frequency MHz	Frequency offset, ± MHz	Low band edge, dBm	RBW, kHz	Integration BW, kHz	Total low band edge*, dBm	Limit, dBm	Verdict
QPSK							
2516.0	20.0	-16.27	300	1000	-13.27	-13.0	Pass
	21.5	-17.09	300	1000	-14.09	-13.0	
2537.0	24.5	-16.90	300	1000	-13.90	-13.0	Pass
	25.5	-16.85	300	1000	-13.85	-13.0	
2548.0	24.5	-17.34	300	1000	-14.34	-13.0	Pass
	25.5	-17.80	300	1000	-14.80	-13.0	
64QAM							
2516.0	20.0	-17.51	390	NA	-14.51	-13.0	Pass
	21.5	-18.36	300	1000	-15.36	-13.0	
2537.0	24.5	-17.10	300	1000	-14.10	-13.0	Pass
	25.5	-17.69	300	1000	-14.69	-13.0	
2548.0	24.5	-18.78	390	NA	-15.78	-13.0	Pass
	25.5	-19.02	300	1000	-16.02	-13.0	

* - Total low band edge = Low Band Edge + 10log(N)

Table 7.8.3 Spurious emission at the high band edge test results

DETECTOR USED: Average
VIDEO BANDWIDTH: ≥ Resolution bandwidth
EBW: 40 MHz
NUMBER OF OUTPUTS: N=2

Frequency MHz	Frequency offset, ± MHz	High band edge, dBm	RBW, kHz	Integration BW, kHz	Total high band edge*, dBm	Limit, dBm	Verdict
QPSK							
2516.0	20.5	-18.13	300	1000	-15.13	-13.0	Pass
	21.5	-18.48	300	1000	-15.48	-13.0	
2537.0	20.5	-17.08	300	1000	-14.08	-13.0	Pass
	21.5	-17.12	300	1000	-14.12	-13.0	
2548.0	20.5	-18.57	300	1000	-15.57	-13.0	Pass
	21.5	-19.71	300	1000	-16.71	-13.0	
64QAM							
2516.0	20.5	-18.13	300	1000	-16.21	-13.0	Pass
	21.5	-18.48	300	1000	-16.34	-13.0	
2537.0	20.5	-16.58	300	1000	-13.58	-13.0	Pass
	21.5	-16.64	300	1000	-13.64	-13.0	
2548.0	20.5	-19.02	390	NA	-16.02	-13.0	Pass
	21.5	-19.01	300	1000	-16.01	-13.0	

* - Total high band edge = High Band Edge + 10log(N)

Reference numbers of test equipment used

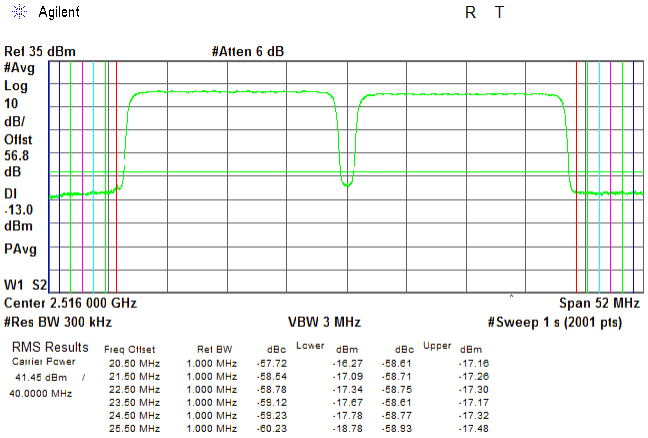
HL 2214	HL 3301	HL 3302	HL 3818	HL 4575			

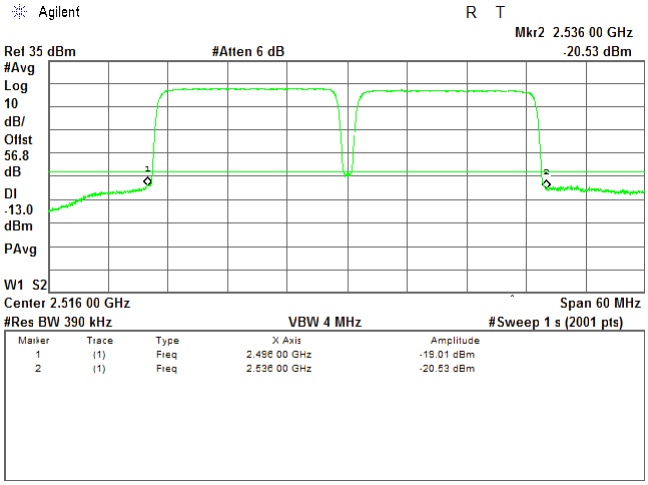
Full description is given in Appendix A.

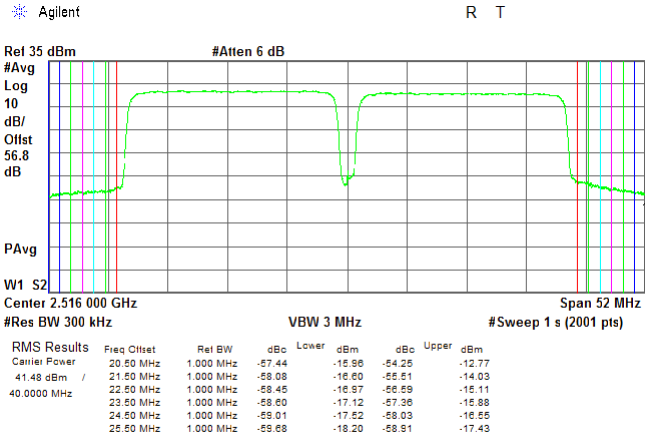
Test specification:	**Section 27.53, Band edge emissions**		
Test procedure:	47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	21-Feb-17 - 22- Feb-17		
Temperature: 23.1 ºC	**Relative Humidity:** 47 %	**Air Pressure:** 1016 hPa	**Power:** 120 VAC
Remarks: Operation in low band 2498.5 – 2565.5 MHz			

Plot 7.8.1 Spurious emission at band edges test results at low carrier frequency, 40 MHz EBW

DETECTOR USED: Average
MODULATION: QPSK
MODULATING SIGNAL: PRBS
BIT RATE: 46.8 Mbps



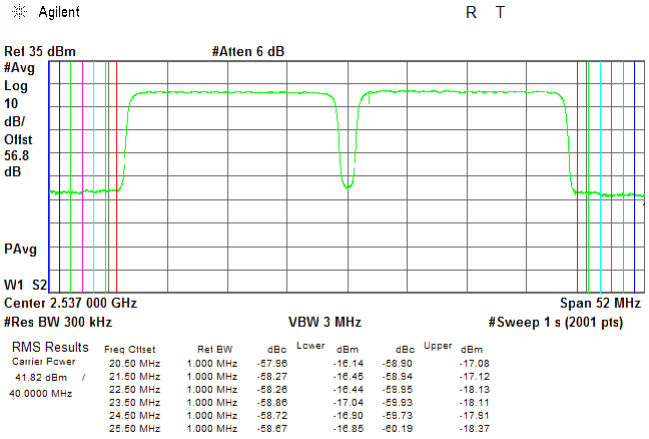




Test specification:	Section 27.53, Band edge emissions		
Test procedure:	47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Feb-17 - 22- Feb-17		
Temperature: 23.1 ºC	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 120 VAC
Remarks: Operation in low band 2498.5 – 2565.5 MHz			

Plot 7.8.2 Spurious emission at band edges test results at mid carrier frequency, 40 MHz EBW

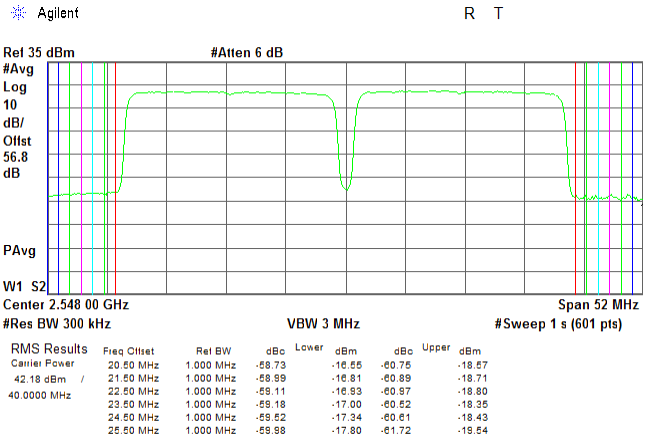
DETECTOR USED:	Average
MODULATION:	QPSK
MODULATING SIGNAL:	PRBS
BIT RATE:	46.8 Mbps

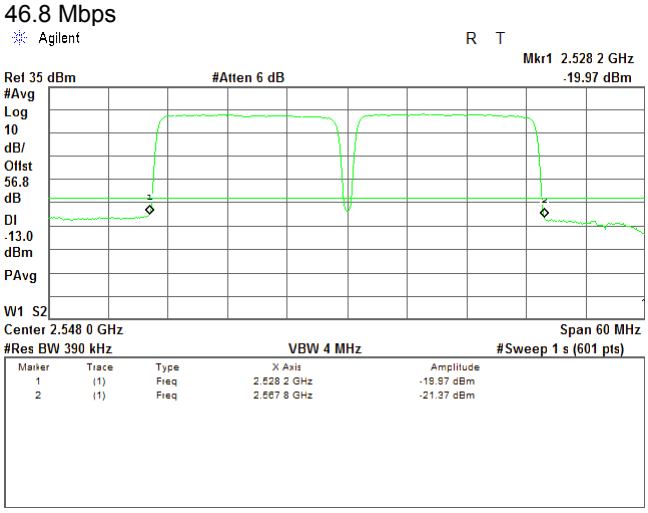


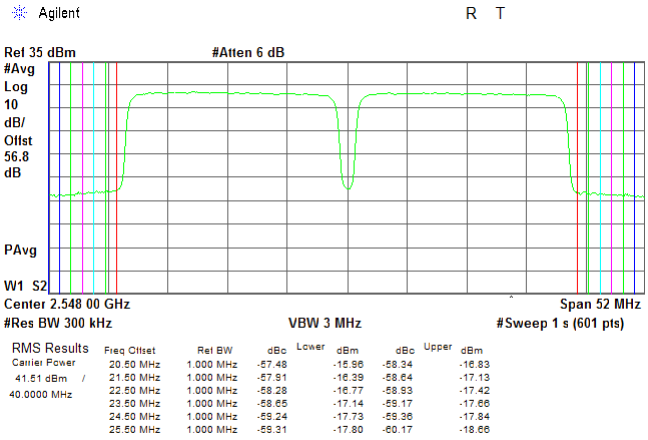
Test specification:	**Section 27.53, Band edge emissions**		
Test procedure:	47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	21-Feb-17 - 22- Feb-17		
Temperature: 23.1 ºC	**Relative Humidity:** 47 %	**Air Pressure:** 1016 hPa	**Power:** 120 VAC
Remarks: Operation in low band 2498.5 – 2565.5 MHz			

Plot 7.8.3 Spurious emission at band edges test results at high carrier frequency, 40 MHz EBW

DETECTOR USED: Average
MODULATION: QPSK
MODULATING SIGNAL: PRBS
BIT RATE: 46.8 Mbps



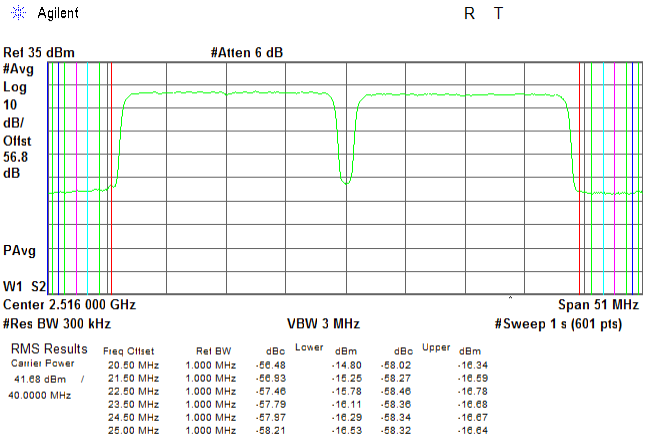


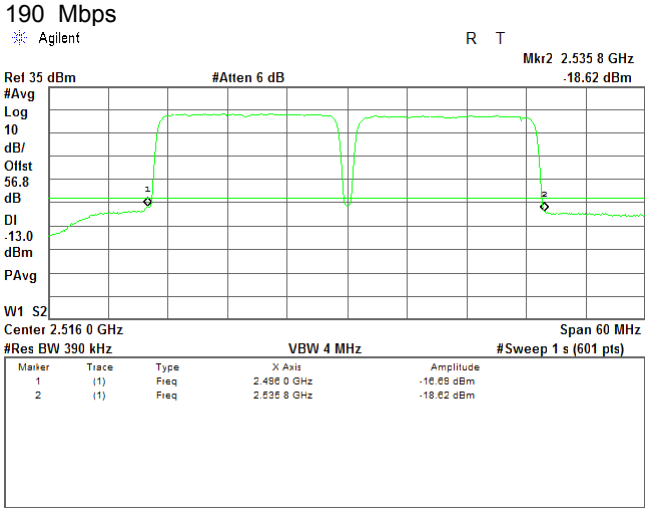


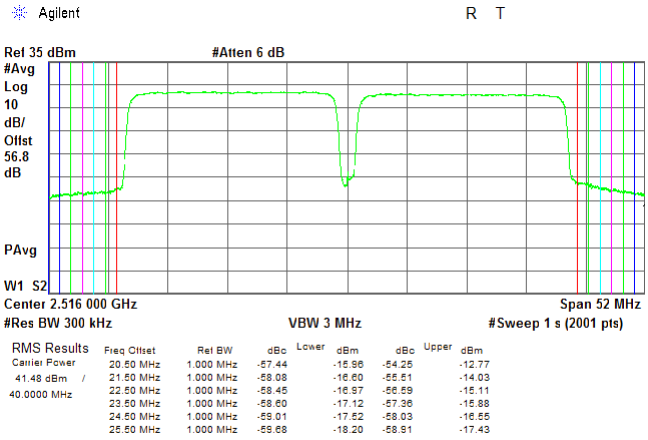
Test specification:	**Section 27.53, Band edge emissions**		
Test procedure:	47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	21-Feb-17 - 22- Feb-17		
Temperature: 23.1 ºC	**Relative Humidity:** 47 %	**Air Pressure:** 1016 hPa	**Power:** 120 VAC
Remarks: Operation in low band 2498.5 – 2565.5 MHz			

Plot 7.8.4 Spurious emission at band edges test results at low carrier frequency, 40 MHz EBW

DETECTOR USED: Average
MODULATION: 64QAM
MODULATING SIGNAL: PRBS
BIT RATE: 190 Mbps



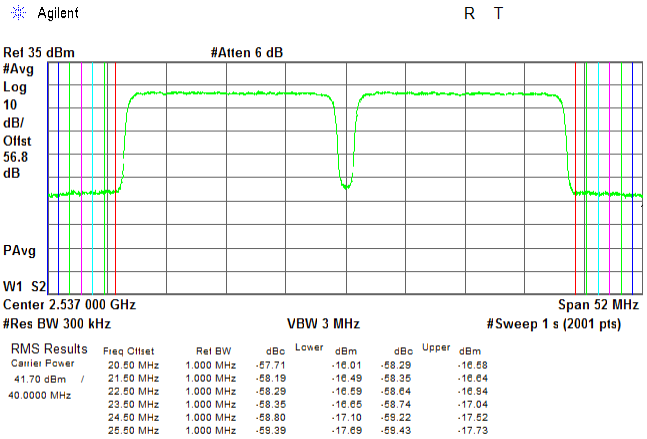


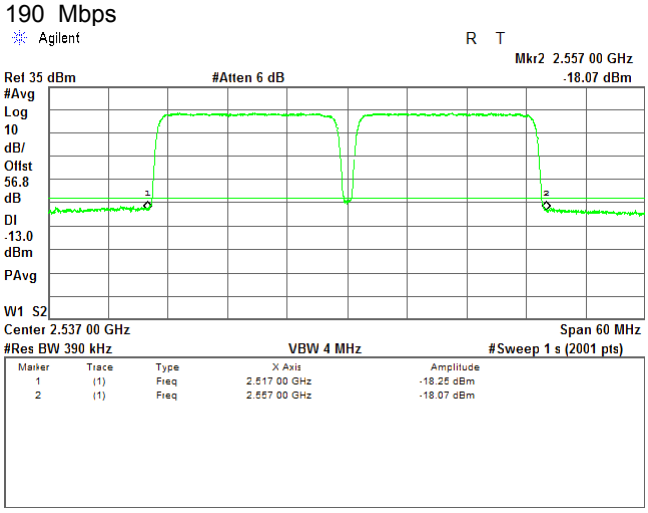


Test specification:	Section 27.53, Band edge emissions		
Test procedure:	47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Feb-17 - 22- Feb-17		
Temperature: 23.1 ºC	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 120 VAC
Remarks: Operation in low band 2498.5 – 2565.5 MHz			

Plot 7.8.5 Spurious emission at band edges test results at mid carrier frequency, 40 MHz EBW

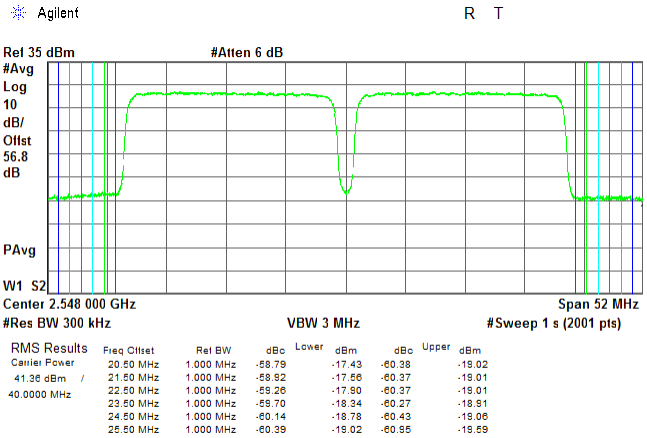
DETECTOR USED: Average
MODULATION: 64QAM
MODULATING SIGNAL: PRBS
BIT RATE: 190 Mbps

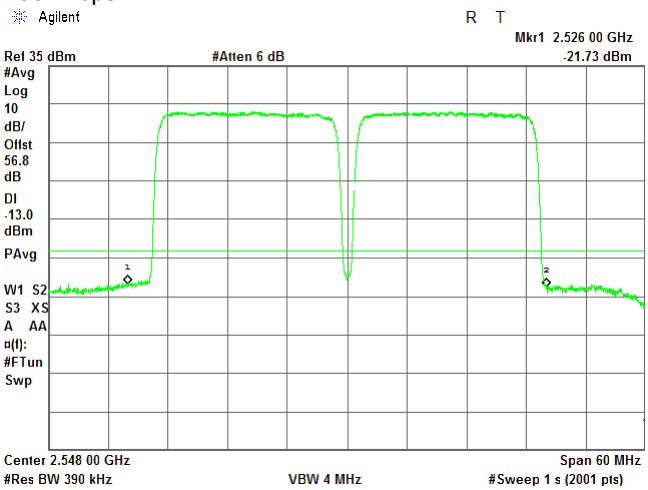




Plot 7.8.6 Spurious emission at band edges test results at high carrier frequency, 40 MHz EBW RF#1

DETECTOR USED: Average
MODULATION: 64QAM
MODULATING SIGNAL: PRBS
BIT RATE: 190 Mbps





Test specification:	Section 27.53, Band edge emissions		
Test procedure:	47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Feb-17		
Temperature: 23.1 ºC	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 120 VAC
Remarks: Operation in high band 2620.5 – 2687.5 MHz			

7.9 Band edge emissions at RF connector test in 2620.5 – 2687.5 MHz band

7.9.1 General

This test was performed to measure spurious emissions at the channel edge at the RF antenna connector. Specification test limits are given in Table 7.9.1.

Table 7.9.1 Spurious emission limits at band edges

Channel	Frequency range	Attenuation below carrier, dBc	Limit, dBm
Channel bandwidth 40 MHz			
2638.0	2618.0 – 2662.0	43+ 10*Log (P*)	-13.0
2653.5	2629.5 – 2673.5	43+ 10*Log (P*)	-13.0
2670.0	2646.0 – 2690.0	43+ 10*Log (P*)	-13.0

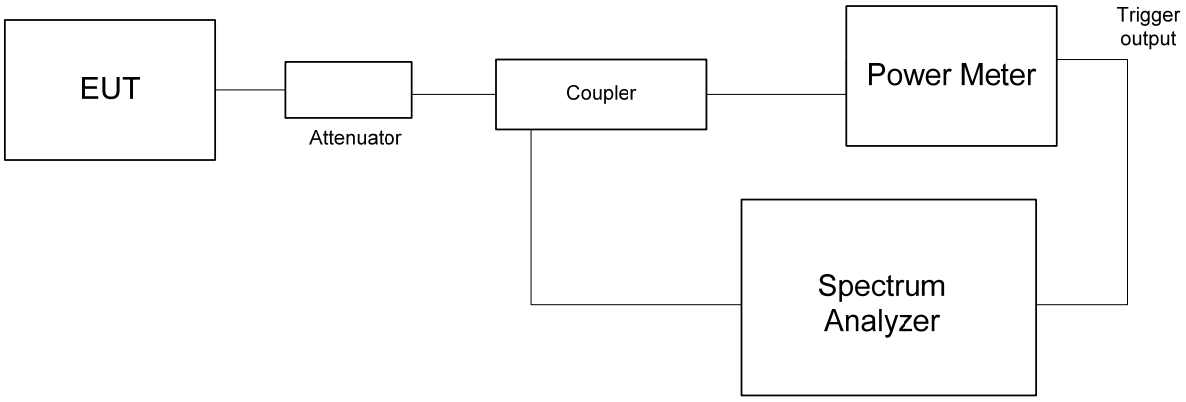
* - P is transmitter output power in Watts

7.9.2 Test procedure

7.9.2.1 The EUT was set up as shown in Figure 7.9.1, energized and its proper operation was checked.

7.9.2.2 The spurious emission was measured with spectrum analyzer as provided in Table 7.9.2, Table 7.9.3 and the associated plots.

Figure 7.9.1 Spurious emission test setup for single output



Test specification:	**Section 27.53, Band edge emissions**		
Test procedure:	47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	22-Feb-17		
Temperature: 23.1 ºC	**Relative Humidity:** 47 %	**Air Pressure:** 1016 hPa	**Power:** 120 VAC
Remarks: Operation in high band 2620.5 – 2687.5 MHz			

Table 7.9.2 Spurious emission at the low band edge test results

DETECTOR USED: Average
VIDEO BANDWIDTH: ≥ Resolution bandwidth
EBW: 40 MHz
NUMBER OF OUTPUTS: N=2

Frequency MHz	Frequency offset, ± MHz	Low band edge, dBm	RBW, kHz	Integration BW, kHz	Total low band edge*, dBm	Limit, dBm	Verdict
QPSK							
2638.0	20.0	-16.36	300	1000	-13.36	-13.0	Pass
	21.5	-17.06	300	1000	-14.06	-13.0	
2653.5	24.0	-17.53	300	1000	-14.53	-13.0	Pass
	25.0	-18.11	300	1000	-15.11	-13.0	
2670.0	24.5	-18.16	300	1000	-15.16	-13.0	Pass
	25.5	-18.60	300	1000	-15.60	-13.0	
64QAM							
2638.0	20.0	-17.12	300	1000	-14.12	-13.0	Pass
	21.5	-17.67	300	1000	-14.67	-13.0	
2653.5	24.0	-17.91	300	1000	-13.66	-13.0	Pass
	25.0	-18.03	300	1000	-14.28	-13.0	
2670.0	24.5	-17.18	390	NA	-14.18	-13.0	Pass
	25.5	-17.58	300	1000	-14.58	-13.0	

* - Total low band edge = Low Band Edge + 10log(N)

Table 7.9.3 Spurious emission at the high band edge test results

DETECTOR USED: Average
VIDEO BANDWIDTH: ≥ Resolution bandwidth
EBW: 40MHz
NUMBER OF OUTPUTS: N=2

Frequency MHz	Frequency offset, ± MHz	High band edge, dBm	RBW, kHz	Integration BW, kHz	Total high band edge*, dBm	Limit, dBm	Verdict
QPSK							
2638.0	24.5	-18.55	300	1000	-15.55	-13.0	Pass
	25.5	-18.90	300	1000	-15.90	-13.0	
2653.5	20.0	-20.49	390	NA	-17.46	-13.0	Pass
	21.5	-16.62	300	1000	-13.62	-13.0	
2670.0	20.5	-16.90	300	1000	-13.90	-13.0	Pass
	21.5	-17.08	300	1000	-14.08	-13.0	
64QAM							
2638.0	24.5	-19.21	300	1000	-16.21	-13.0	Pass
	25.5	-19.34	300	1000	-16.34	-13.0	
2653.5	20.5	-16.79	300	1000	-13.79	-13.0	Pass
	21.5	-17.52	300	1000	-14.52	-13.0	
2670.0	20.5	-17.49	390	NA	-14.49	-13.0	Pass
	21.5	-17.04	300	1000	-14.04	-13.0	

* - Total high band edge = High Band Edge + 10log(N)

Reference numbers of test equipment used

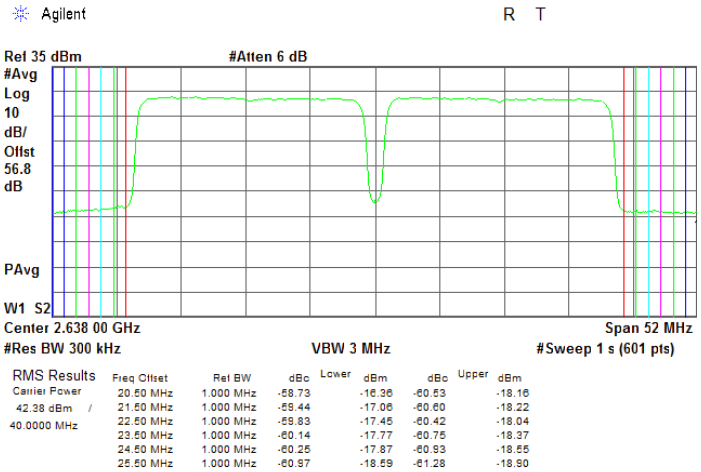
HL 2214	HL 3301	HL 3302	HL 3818	HL 4575			

Full description is given in Appendix A.

Test specification:	Section 27.53, Band edge emissions		
Test procedure:	47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Feb-17		
Temperature: 23.1 ºC	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 120 VAC
Remarks: Operation in high band 2620.5 – 2687.5 MHz			

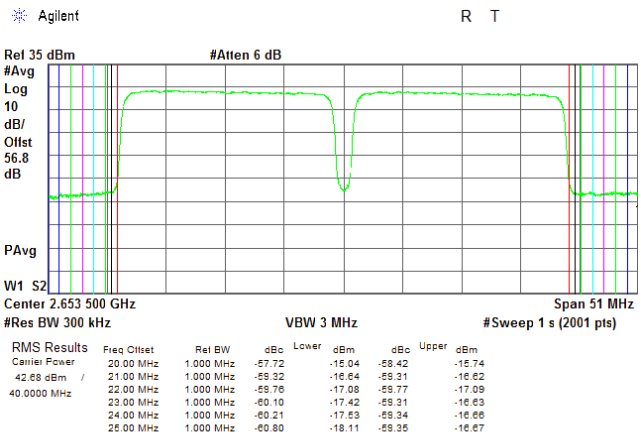
Plot 7.9.1 Spurious emission at band edges test results at low carrier frequency, 40 MHz EBW

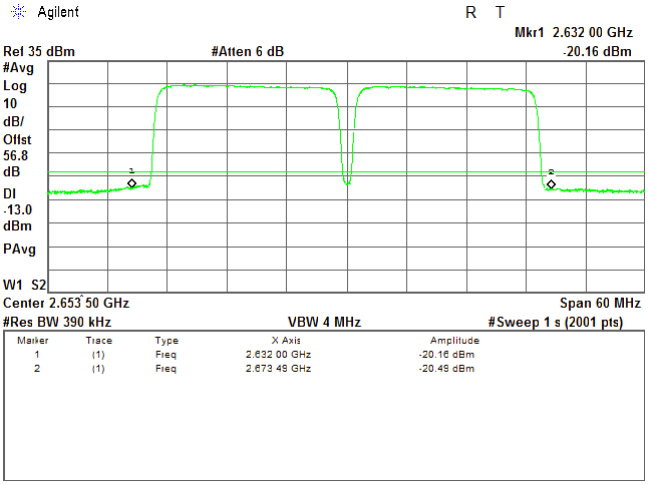
DETECTOR USED: Average
MODULATION: QPSK
MODULATING SIGNAL: PRBS
BIT RATE: 46.8 Mbps



Plot 7.9.2 Spurious emission at band edges test results at mid carrier frequency, 40 MHz EBW

DETECTOR USED: Average
MODULATION: QPSK
MODULATING SIGNAL: PRBS
BIT RATE: 46.8 Mbps

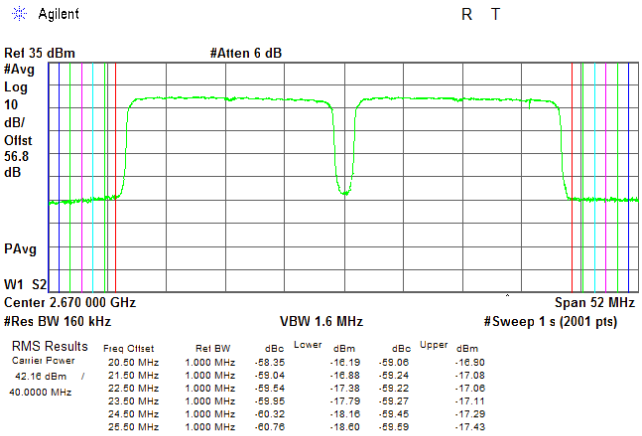




Test specification:	**Section 27.53, Band edge emissions**		
Test procedure:	47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	22-Feb-17		
Temperature: 23.1 ºC	**Relative Humidity:** 47 %	**Air Pressure:** 1016 hPa	**Power:** 120 VAC
Remarks: Operation in high band 2620.5 – 2687.5 MHz			

Plot 7.9.3 Spurious emission at band edges test results at high carrier frequency, 40 MHz EBW

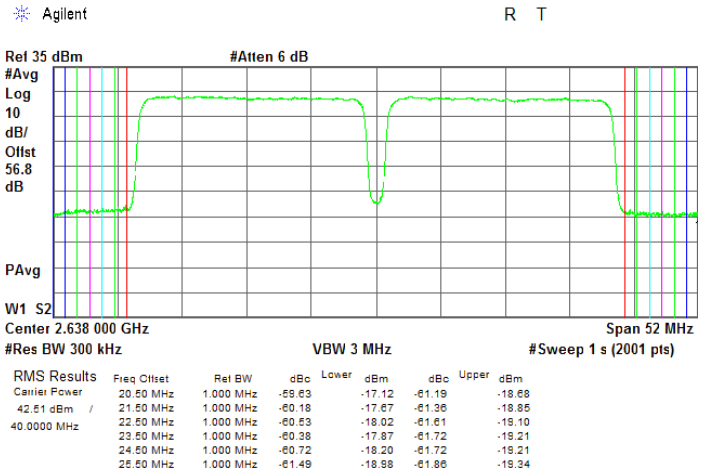
DETECTOR USED: Average
MODULATION: QPSK
MODULATING SIGNAL: PRBS
BIT RATE: 46.8 Mbps



Test specification:	Section 27.53, Band edge emissions		
Test procedure:	47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Feb-17		
Temperature: 23.1 ºC	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 120 VAC
Remarks: Operation in high band 2620.5 – 2687.5 MHz			

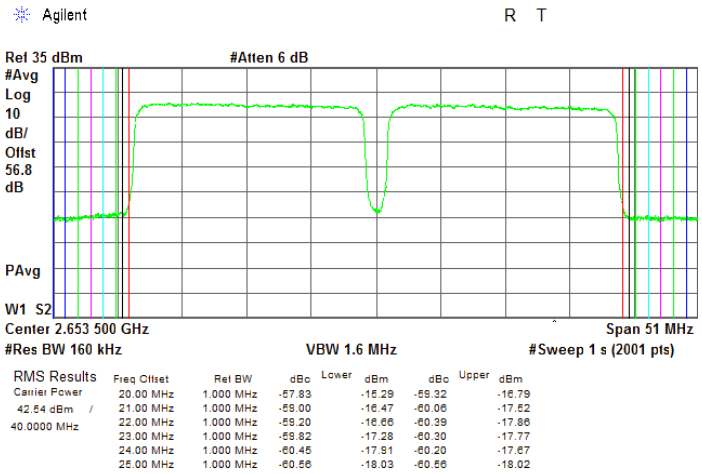
Plot 7.9.4 Spurious emission at band edges test results at low carrier frequency, 40 MHz EBW

DETECTOR USED:	Average
MODULATION:	64QAM
MODULATING SIGNAL:	PRBS
BIT RATE:	190 Mbps



Plot 7.9.5 Spurious emission at band edges test results at mid carrier frequency, 40 MHz EBW

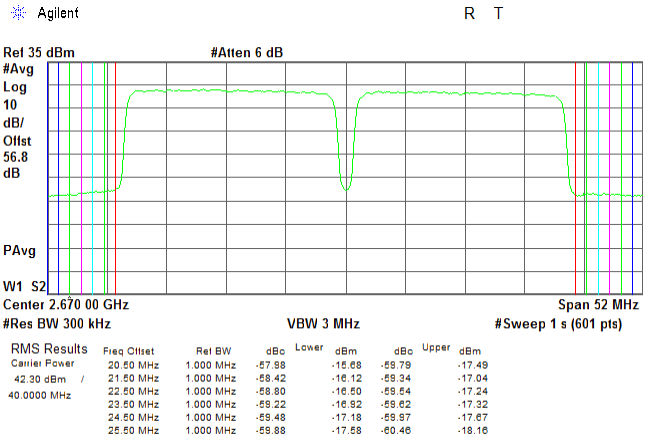
DETECTOR USED:	Average
MODULATION:	64QAM
MODULATING SIGNAL:	PRBS
BIT RATE:	190 Mbps

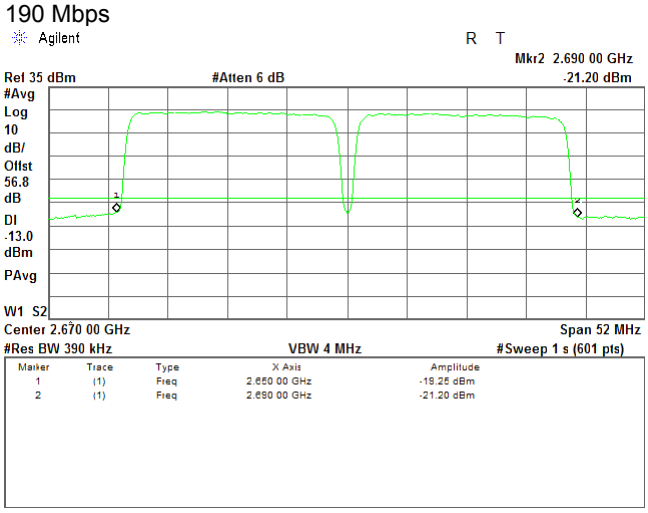


Test specification:	**Section 27.53, Band edge emissions**		
Test procedure:	47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	22-Feb-17		
Temperature: 23.1 ºC	**Relative Humidity:** 47 %	**Air Pressure:** 1016 hPa	**Power:** 120 VAC
Remarks: Operation in high band 2620.5 – 2687.5 MHz			

Plot 7.9.6 Spurious emission at band edges test results at high carrier frequency, 40 MHz EBW

DETECTOR USED: Average
MODULATION: 64QAM
MODULATING SIGNAL: PRBS
BIT RATE: 190 Mbps





8 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
2214	Directional Coupler 1.7-26.5 GHz	Krytar	2616	31354	16-Sep-15	16-Sep-17
3301	Power Meter, P-series, 50 MHz to 40 GHz	Agilent Technologies	N1911A	MY45101057	26-Apr-16	26-Apr-17
3302	Power sensor, P-Series, 50 MHz to 40 GHz, -35/30 to 20 dBm	Agilent Technologies	N1922A	MY45240586	26-Apr-16	26-Apr-17
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY48250288	03-May-16	03-May-17
3901	Microwave Cable Assembly, 40.0 GHz, 3.5 m, SMA/SMA	Huber-Suhner	SUCOFLEX 102A	1225/2A	20-Feb-17	20-Feb-18
4274	Test Cable , DC-18 GHz, 1.8 m, SMA/M - N/M	Mini-Circuits	CBL-6FT-SMNM+	70047	30-May-16	30-May-17
4575	EXA Signal Analyzer, 9 kHz - 26.5 GHz	Agilent Technologies	N9010A	MY48030110	17-Feb-17	17-Mar-18

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 facility description

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private, EMC, safety, environmental and telecommunication testing facility.
Hermon Laboratories is recognized and accredited by the Federal Communications Commission (USA) for 1, 2, 15, 18 parts of Code of Federal Regulations 47 (CFR 47), Test Firm Registration Number is 927748, Designation Number is IL1001; registered by Industry Canada for electromagnetic emissions, file number IC 2186A-1 for OATS, certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-1082 for anechoic chamber, G-869 for RE measurements above 1 GHz, C-845 for conducted emissions site, T-1606 for conducted emissions at telecommunication ports). 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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website: www.hermonlabs.com

Person for contact: Mr. Alex Usoskin, CEO.

11 APPENDIX D Specification references

47CFR part 27: 2016	Private land mobile radio services
47CFR part 1: 2015	Practice and procedure
47CFR part 2: 2015	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: 2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
ANSI/TIA/EIA-603-D:2010	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards

12 APPENDIX E Test equipment correction factors

Cable loss
Microwave Cable Assembly, Huber-Suhner, 40 GHz, 3.5 m, SMA-SMA, S/N 1225/2A
HL 3901

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.09	9500	4.29	21000	6.67
100	0.41	10000	4.40	22000	6.92
500	0.93	10500	4.52	23000	7.00
1000	1.33	11000	4.64	24000	7.18
1500	1.63	11500	4.76	25000	7.29
2000	1.90	12000	4.87	26000	7.55
2500	2.12	12500	4.99	27000	7.70
3000	2.33	13000	5.11	28000	7.88
3500	2.50	13500	5.20	29000	8.02
4000	2.67	14000	5.31	30000	8.15
4500	2.82	14500	5.42	31000	8.35
5000	2.99	15000	5.51	32000	8.40
5500	3.16	15500	5.58	33000	8.62
6000	3.32	16000	5.68	34000	8.73
6500	3.51	16500	5.78	35000	8.78
7000	3.65	17000	5.91	36000	8.94
7500	3.79	17500	5.99	37000	9.21
8000	3.92	18000	6.07	38000	9.37
8500	4.04	19000	6.36	39000	9.45
9000	4.18	20000	6.49	40000	9.52

Cable loss
Test cable, Mini-Circuits, S/N 70047, 18 GHz, 1.8 m, SMA/M - N/M
CBL-6FT-SMNM+, HL 4274

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.07	4800	1.69	9800	2.62	14800	3.42
30	0.11	4900	1.70	9900	2.63	14900	3.39
50	0.14	5000	1.72	10000	2.64	15000	3.38
100	0.21	5100	1.75	10100	2.64	15100	3.40
200	0.26	5200	1.76	10200	2.66	15200	3.41
300	0.30	5300	1.77	10300	2.67	15300	3.40
400	0.37	5400	1.79	10400	2.68	15400	3.39
500	0.44	5500	1.82	10500	2.68	15500	3.41
600	0.49	5600	1.85	10600	2.70	15600	3.44
700	0.54	5700	1.86	10700	2.71	15700	3.46
800	0.58	5800	1.87	10800	2.73	15800	3.45
900	0.63	5900	1.91	10900	2.74	15900	3.47
1000	0.67	6000	1.94	11000	2.76	16000	3.51
1100	0.71	6100	1.97	11100	2.77	16100	3.56
1200	0.75	6200	1.98	11200	2.78	16200	3.55
1300	0.78	6300	1.99	11300	2.79	16300	3.54
1400	0.81	6400	2.02	11400	2.80	16400	3.57
1500	0.85	6500	2.05	11500	2.82	16500	3.62
1600	0.88	6600	2.06	11600	2.83	16600	3.61
1700	0.91	6700	2.06	11700	2.84	16700	3.60
1800	0.94	6800	2.08	11800	2.85	16800	3.62
1900	0.97	6900	2.10	11900	2.87	16900	3.68
2000	1.00	7000	2.12	12000	2.88	17000	3.70
2100	1.03	7100	2.12	12100	2.89	17100	3.68
2200	1.06	7200	2.13	12200	2.90	17200	3.70
2300	1.08	7300	2.16	12300	2.92	17300	3.80
2400	1.11	7400	2.19	12400	2.94	17400	3.84
2500	1.14	7500	2.22	12500	2.95	17500	3.83
2600	1.16	7600	2.23	12600	2.96	17600	3.83
2700	1.19	7700	2.26	12700	2.98	17700	3.86
2800	1.21	7800	2.30	12800	3.00	17800	3.86
2900	1.27	7900	2.33	12900	3.02	17900	3.80
3000	1.29	8000	2.35	13000	3.03	18000	3.79
3100	1.32	8100	2.37	13100	3.06		
3200	1.35	8200	2.41	13200	3.08		
3300	1.37	8300	2.44	13300	3.09		
3400	1.38	8400	2.47	13400	3.10		
3500	1.41	8500	2.48	13500	3.13		
3600	1.43	8600	2.51	13600	3.17		
3700	1.46	8700	2.53	13700	3.17		
3800	1.47	8800	2.55	13800	3.18		
3900	1.49	8900	2.56	13900	3.22		
4000	1.52	9000	2.57	14000	3.26		
4100	1.55	9100	2.58	14100	3.28		
4200	1.56	9200	2.59	14200	3.30		
4300	1.58	9300	2.59	14300	3.35		
4400	1.60	9400	2.60	14400	3.39		
4500	1.63	9500	2.60	14500	3.39		
4600	1.65	9600	2.61	14600	3.39		
4700	1.67	9700	2.61	14700	3.41		

13 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
A/m	ampere per meter
AM	amplitude modulation
AVRG	average (detector)
BB	broad band
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dB(μV)	decibel referred to one microvolt
dB(μA)	decibel referred to one microampere
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
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
μs	microsecond
NA	not applicable
NB	narrow band
NT	not tested
Ω	Ohm
QP	quasi-peak
PM	pulse modulation
PS	power supply
RE	radiated emission
RF	radio frequency
rms	root mean square
Rx	receive
s	second
Tx	transmit
V	volt
VA	volt-ampere

END OF DOCUMENT