902-928 MHz Radio Test Report
FHSS/HYBRID

For
IR530SB-OFD-FCC/K9
FSK/OQPSK/OFDM
802.15.4g/e

FCC ID: LDK-IR530OFDM
IC ID: 2461N-IR530OFDM
Against the following Specifications:
47 CFR 15.247
47 CFR 15.209
47 CFR 15.205
47 CFR 15.207
RSS 247 Issue 2

Cisco Systems
EMC Laboratory
170 West Tasman Drive
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ACCREDITED

Author: Ronak Patel
Approved By: Adam Walb
Title: See EDCS
Revision: See EDCS

This report replaces any previously entered test report under EDCS # **12707892.** This test report has been electronically authorized and archived using the CISCO Engineering Document Control system. Test Report Template EDCS# 11377496

Section 1: Overview

1.1 Test Summary

The samples were assessed against the tests detailed in section 3 under the requirements of the following specifications:

Specifications
FCC 15.247 RSS 247 Issue 2 RSS Gen Issue 4

Notes: Measurements were made in accordance with FCC Public Notice #: DA 00-0705 & ANSI C63.10:2013.

Section 2: Assessment Information

2.1 General

This report contains an assessment of an apparatus against Radio Standards based upon tests carried out on the samples submitted. The testing was performed by and for the use of Cisco systems Inc:

With regard to this assessment, the following points should be noted:

a) The results contained in this report relate only to the items tested and were obtained in the period between the date of the initial assessment and the date of issue of the report. Manufactured products will not necessarily give identical results due to production and measurement tolerances.

b) The apparatus was set up and exercised using the configuration and modes of operation defined in this report only.

c) Where relevant, the apparatus was only assessed using the susceptibility criteria defined in this report and the Test Assessment Plan (TAP).

d) All testing was performed under the following environmental conditions:

Temperature	10°C to 40°C (50°F to 104°F)
Atmospheric Pressure	860mbar to 1060mbar (25.4" to 31.3")
Humidity	10% to 90%

e) All AC testing was performed at one or more of the following supply voltages:
110V 60 Hz (+/-20%)

2.2 Units of Measurement

The units of measurements defined in the appendices are reported in specific terms, which are test dependent. Where radiated measurements are concerned these are defined at a particular distance. Basic voltage measurements are defined in units of [dBuV]

As an example, the basic calculation for all measurements is as follows:

Emission level [dBuV] = Indicated voltage level [dBuV] + Cable Loss [dB] + Other correction factors [dB]

The combinations of correction factors are dependent upon the exact test configurations [see test equipment lists for further details] and may include:-

Antenna Factors, Pre Amplifier Gain, LISN Loss, Pulse Limiter Loss and Filter Insertion Loss..

Note: to convert the results from dBuV/m to uV/m use the following formula:-

Level in uV/m = Common Antilogarithm [(X dBuV/m)/20] = Y uV/m

Measurement Uncertainty Values

voltage and power measurements	± 2 dB
conducted EIRP measurements	± 1.4 dB
radiated measurements	± 3.2 dB
frequency measurements	± 2.4 10-7
temperature measurements	± 0.54º.
humidity measurements	± 2.3%
DC and low frequency measurements	± 2.5%.

Where relevant measurement uncertainty levels have been estimated for tests performed on the apparatus. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Radiated emissions (expanded uncertainty, confidence interval 95%)

30 MHz - 300 MHz	+/- 3.8 dB
300 MHz - 1000 MHz	+/- 4.3 dB
1 GHz - 10 GHz	+/- 4.0 dB
10 GHz - 18GHz	+/- 8.2 dB
18GHz - 26.5GHz	+/- 4.1 dB
26.5GHz - 40GHz	+/- 3.9 dB

Conducted emissions (expanded uncertainty, confidence interval 95%)

30 MHz – 40GHz	+/- 0.38 dB

A product is considered to comply with a requirement if the nominal measured value is below the limit line. The product is considered to not be in compliance in case the nominal measured value is above the limit line.

2.3 Date of testing (initial sample receipt date to last date of testing)

1st January 2018 to 28 January 2018

2.4 Report Issue Date

Cisco uses an electronic system to issue, store and control the revision of test reports. This system is called the DOC Central document control system. The actual report issue date is embedded into the original file in DOC Central. Any copies of this report, either electronic or paper, that are not on DOC Central must be considered uncontrolled

2.5 Testing facilities

This assessment was performed by:

Testing Laboratories

Cisco Systems, Inc.
125 West Tasman Drive (Building P)
San Jose, CA 95134
USA

Headquarters

Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134
USA

Registration Numbers for Industry Canada

Cisco System Site	Address	Site Identifier
Building P, 5m Chamber	125 West Tasman Drive San Jose, CA 95134	Company #: 2461N-1

Test Engineer

Ronak Patel

2.6 Equipment Assessed (EUT)

IR530SB-OFD-FCC/K9

2.7 EUT Description

The Cisco® IR500 range extender provides unlicensed 902-928MHz, ISM-band IEEE 802.15.4g/e/v wireless personal-area network (WPAN) communications to diverse Internet of things (IoT) applications. It extends the range of the RF wireless mesh network, providing longer reach between WPAN endpoints and other WPAN networks. There are two products in the family: The IR529 and IR530. IR530 represents a high performance, new generation of the Cisco RF Mesh range extender.

The IR530 Range extenders take full advantage of world class Cisco networking expertise in IPv6, security. It provides an open, high performance RF mesh solution based on the following standards:

IEEE 802.15.4 g/e/v
IETF 6LoWPAN
IETF Routing Protocol for Low Power and Lossy Networks (RPL)
IETF Constrained Application Protocol (CoAP)

IR530 is the next generation Field Area Network solution to meet the demands of Smart Grid applications such as distribution automation, distributed generation, renewable energy, PEV charging stations, generic SCADA telemetry applications and water, oil & gas applications.

IR530 includes solution requirements such as higher bandwidth, lower latency, higher availability, improved security, fog computing, and Wi-SUN compliance for CG-Mesh.

Section 3: Result Summary

3.1 Results Summary Table

Basic Standard	Technical Requirements / Details	Result
FCC 15.247 **RSS-247**	**20 dB Bandwidth (2FSK and OQPSK)**: For frequency hopping systems operating in the 902-928 MHz band: The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz **6 dB and 99 % Bandwidth (OFDM)**: 99% OCB is required only for Average Power measurement The minimum 6 dB bandwidth of a DTS transmission shall be at least 500 kHz.	Pass
FCC 15.247 **RSS-247**	**Maximum Peak Conducted Output Power (2FSK and OQPSK)**: For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power **Maximum Peak Conducted Output Power (OFDM)**: For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one-Watt limit can be based on a measurement of the maximum conducted output power	Pass
FCC 15.247 **RSS-247**	**Power Spectral Density (OFDM Modes) :** The power spectral density conducted from the intentional radiator to the antenna due to the digital modulation operation of the hybrid system, with the frequency hopping operation turned off, shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.	Pass
FCC 15.247 **RSS-247**	**Carrier Frequency Separation (2FSK and OQPSK Modes)**: Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater	Pass

FCC 15.247 **RSS-247**	**Average Time of Occupancy (2FSK and OQPSK Modes)**: For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20-second period. **Average Time of Occupancy (OFDM Modes)**: The frequency hopping operation of the hybrid system, with the direct sequence or digital modulation operation turned-off, shall have an average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4	Pass
FCC 15.247 **RSS-247**	**Conducted Band-Edge**: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter Demonstrates compliance with the peak conducted power limits	Pass
FCC15.247/15.205 **RSS-Gen 8.10**	**Restricted band**: Unwanted emissions falling within the restricted bands, as defined in FCC 15.205 (a) and RSS-Gen 6.13 must also comply with the radiated emission limits specified in FCC 15.209 (a) and RSS-Gen 8.10	Pass

Radiated Emissions

Basic Standard	Technical Requirements / Details	Result
FCC 15.209 (a) **RSS-Gen 6.13**	**TX Spurious Emissions:** Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the filed strength limits table in this section.	Pass

***** MPE calculation is recorded in a separate report

Section 4: Sample Details

Note: Each sample was evaluated to ensure that its condition was suitable to be used as a test sample prior to the commencement of testing. Please also refer to the "Justification for worst Case test Configuration" section of this report for further details on the selection of EUT samples.

4.1 Sample Details

Sample No.	Equipment Details	Manufacturer	Hardware Rev.	Firmware Rev.	Software Rev.	Serial Number
S01	IR530SB-OFD-FCC/K9	Cisco Systems, Inc.	01	6.0.1	6.0.1	FCW2125004F

4.2 System Details

Sample No.	Description	Samples
1	S01	Conducted and Radiated Testing

4.3 Antenna Information

The following antennas are supported by this product series.

Antenna	Frequency (MHz)	Peak gain (dBi)	Radiation pattern	Connector	Mounting	Mechanical specifications
ANT-WPAN-OD-OUT-N	863 – 928	1.5	Omnidirectional dipole, 84° vertical HPBW	N(m)	Direct connection to N(f) bulkhead adapter or lightning arrestor	7.7" long, 1.02" diameter IP67 -40 to +85°C operating
ANT-LPWA-DB-O-N-5	863 - 928	5.6	Omnidirectional collinear dipole, 24 - 28° vertical HPBW	N(m)	Direct connection to N(f) bulkhead adapter or lightning arrestor	28" long, 1" diameter IP67 -40 to +70° C operating

4.3 Mode of Operation Details

Mode#	Description	Comments
1	Mgmtserialtest	Mgmtserialtest version allows to do conducted and Radiated testing at antenna port of EUT. Image version : 5.7.20

4.4 Test Mode, Modulation and Data Packet Type Description

Test Mode	Modulation Type	Data Rate (kbps)	Chanel Spacing (kHz)	No of Channels	Mode
A	2FSK	50	200	129	64
B	2FSK	50	200	129	96
C	2FSK	150	400	64	66
D	2FSK	150	400	64	98
E	O-QPSK	6.25	200	129	192
F	OFDM	50	800	31	144
G	OFDM	200	800	31	146
H	OFDM	400	800	31	147
I	OFDM	800	800	31	149
J	OFDM	1200	800	31	150

Note 1: 2FSK and O-QPSK Operates as Frequency Hopping Spread Spectrum Modulations
Note 2: OFDM Operates as Hybrid Modulation (DSSS and FHSS together)
Note 3: The channel spacing is 200 kHz and 400 kHz for 2-FSK at 50 kbps and 150kbps respectively and 800 kHz for OFDM Option 2.

There will be 129 Channels with 200 kHz Channel Spacing for 2FSK and 64 Channels with 400kHz Channel spacing and 31 OFDM RF channels with 800kHz Channel Spacing.

4.5 Transmit Power versus Channel

Channel 0 through 128			
Mode	**Rate kbps**	**Raw DEC/Hex**	**Pout dBm**
64	50	24/0x18	29
96	50	24/0x18	29
66	150	24/0x18	29
98	150	24/0x18	29
192	6.2	24/0x18	29

OFDM Modes							
Channel 0				**Channel 1 thru 31**			
Mode	**Rate kbps**	**Raw DEC/Hex**	**Pout dBm**	**Mode**	**Rate kbps**	**Raw Dec/Hex**	**Pout dBm**
144	50	18/0x12	23	144	50	27/0x1b	28
146	200	18/0x12	23	146	200	27/0x1b	28
147	400	18/0x12	23	147	400	25/0x19	27
149	800	18/0x12	23	149	800	21/0x15	25
150	1200	18/0x12	23	150	1200	18/0x12	23

Appendix A: Conducted Test Results

Duty Cycle

Duty Cycle Test Requirement
From KDB 558074 D01 DTS Meas Guidance v04

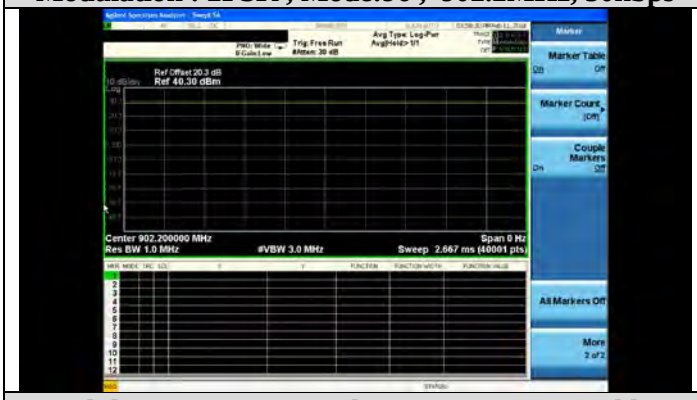
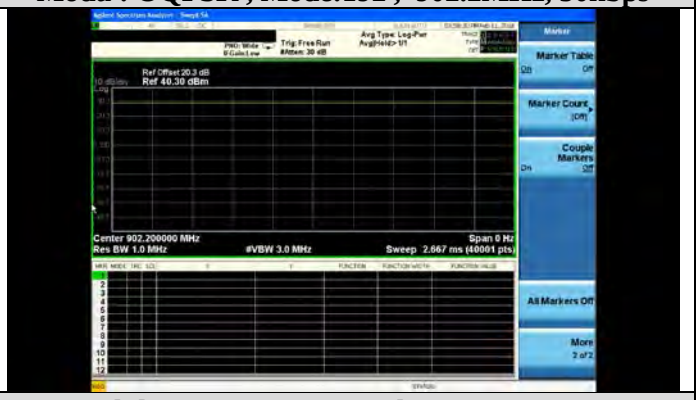
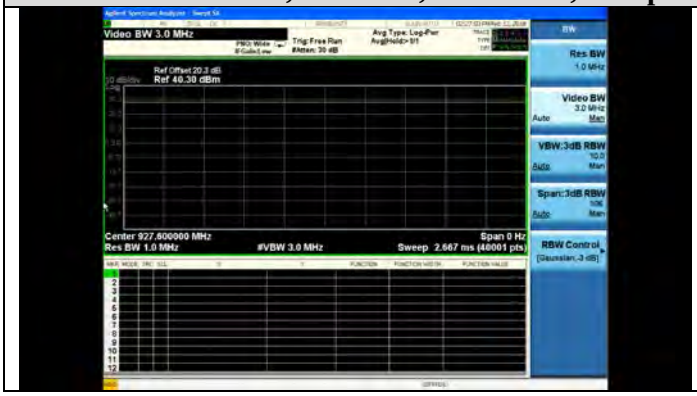
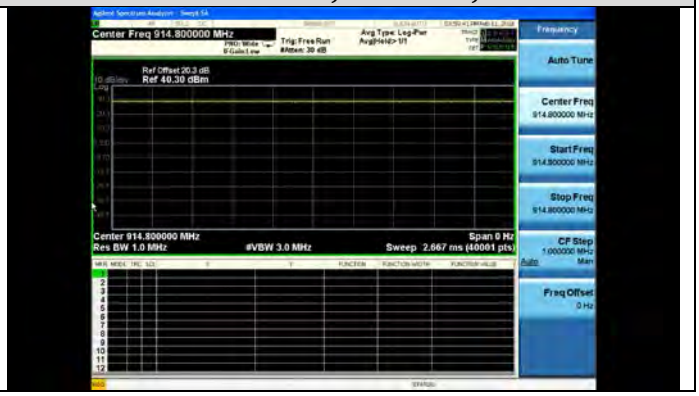
1. All measurements are to be performed with the EUT transmitting at 100 percent duty cycle at its maximum power control level; however, if 100 percent duty cycle cannot be achieved, measurements of duty cycle, x, and maximum-power transmission duration, *T*, are required for each tested mode of operation.

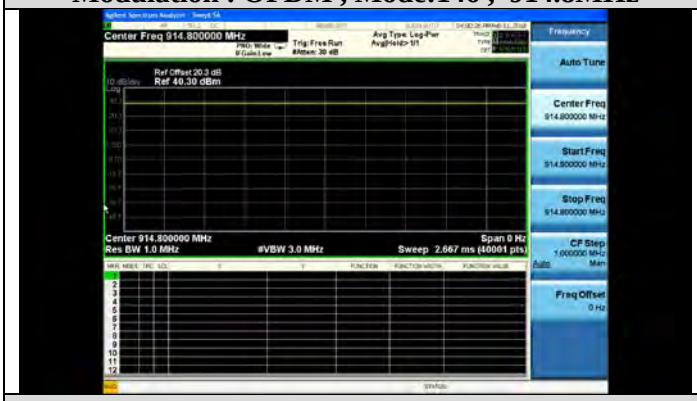
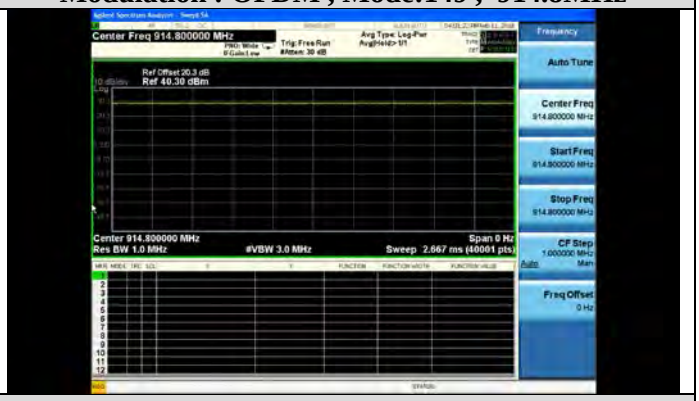
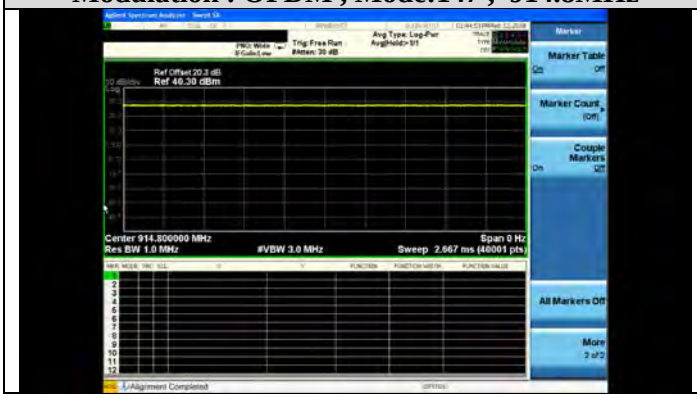
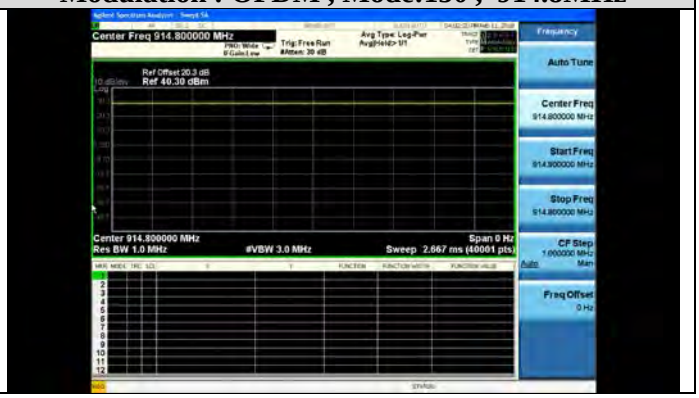
Duty Cycle Test Method
From KDB 558074 D01 DTS Meas Guidance v04

a) A diode detector and an oscilloscope that together have sufficiently short response time to permit accurate measurements of the on- and off-times of the transmitted signal.
b) The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on- and off-times of the transmitted signal.

1) Set the center frequency of the instrument to the center frequency of the transmission.
2) Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value.
3) Set detector = peak or average.
4) The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T ≤ 16.7 microseconds.)

Duty Cycle Plots

Duty Cycle Results	
Modulation : 2FSK , Mode:64 , 902.2MHz, 50kbps	**Modulation : 2FSK , Mode:98 , 927.6MHz, 50kbps**
	
Modulation : 2FSK , Mode:96 , 902.2MHz, 50kbps	**Modu : OQPSK , Mode:192 , 902.2MHz, 50kbps**
	
Modulation : 2FSK , Mode:66 , 927.6MHz, 50kbps	**Modulation : OFDM , Mode:144, 927.8MHz**
	

Duty Cycle Results	
Modulation : OFDM , Mode:146 , 914.8MHz	**Modulation : OFDM , Mode:149 , 914.8MHz**
	
Modulation : OFDM , Mode:147 , 914.8MHz	**Modulation : OFDM , Mode:150 , 914.8MHz**
	

Duty Cycle is 100% for all modes

A.1 20dB Bandwidth (2FSK and O-QPSK Modes)

FCC 15.247(a) (1) (i), RSS- 247 5.1(c)
The 20 dB emission bandwidth is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated 20 dB below the maximum in-band spectral density of the modulated signal

A.1.1 Limits

FCC 15.247(a) (1) (i), RSS- 247 5.1(c)

For frequency hopping systems operating in the 902-928 MHz band: The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz

A.1.2 Test Procedure

Refer to Public Notice DA 00-705
Step 1: Edit the spectrum analyzer settings according to the parameters below.

-Center Frequency: frequency under test
-Span: approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
-RBW: ≥ 1% of the 20 dB bandwidth
-VBW: ≥ RBW
- Sweep: Auto Couple
-Ref Level: 10dB (or higher if required)
-Attenuation: 20dB (if required)
-Detector: Peak
- Trace Mode: Max Hold

Step 2: The EUT is set in a transmitter mode at its maximum data rate. Allow the trace to stabilize, use the marker-to-peak function to set the marker to the peak of the emission. Then use the marker-normal function to place at the 20 dB down on one side of the emission. Reset with the marker-delta function and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation. Record data.

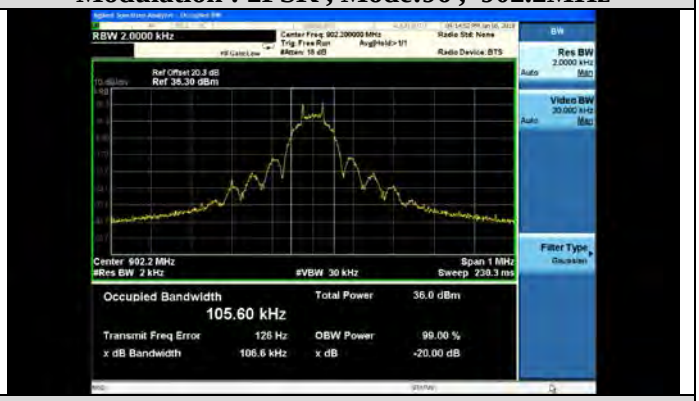
Step 3:

• Record the x dB Bandwidth = -20 dB.
This value should be in the test report.

A.1.3 20dB Occupied Bandwidth Data Table

20dB Bandwidth					
Modulation Type	**Phymode**	**Frequency (MHz)**	**Data rate (kbps)**	**Channel Spacing (kHz)**	**20dB BW (kHz)**
2FSK	64	902.2	50	200	111.7
		915.0	50	200	110.7
		927.8	50	200	109.2
2FSK	96	902.2	50	200	106.6
		915.0	50	200	110.3
		927.8	50	200	106.6
2FSK	66	902.4	150	400	194.1
		915.2	150	400	196.0
		927.6	150	400	189.3
2FSK	98	902.4	150	400	195.9
		915.2	150	400	191.8
		927.6	150	400	190.7
O-QPSK	192	902.2	6.25	200	128.0
		915.0	6.25	200	128.1
		927.8	6.25	200	128.3

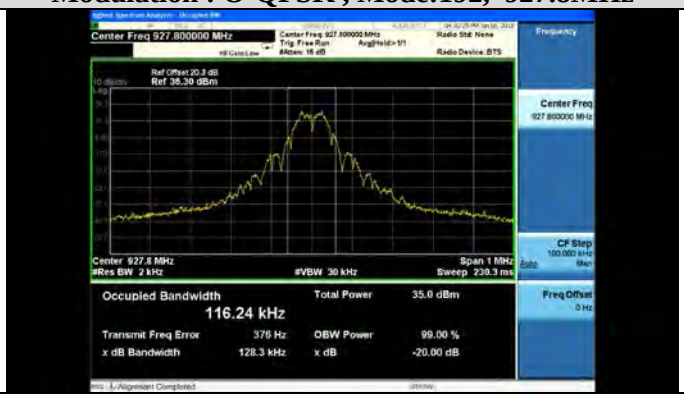
A.1.4 20dB Occupied Bandwidth Graphical Test Results (2FSK and OQPSK Modes)

20dB Ocuupied Bandwidth Results	
Modulation : 2FSK , Mode:64 , 902.2MHz	**Modulation : 2FSK , Mode:96 , 902.2MHz**
	
Modulation : 2FSK , Mode:64 , 915MHz	**Modulation : 2FSK , Mode:96 , 915MHz**
	
Modulation : 2FSK , Mode:64 , 927.8MHz	**Modulation : 2FSK , Mode:96, 927.8MHz**
	

20dB Ocuupied Bandwidth Results	
Modulation : 2FSK , Mode:66 , 902.4MHz	**Modulation : 2FSK , Mode:98 , 902.4MHz**
	
Modulation : 2FSK , Mode:66 , 915.2MHz	**Modulation : 2FSK , Mode:98 , 915.2MHz**
	
Modulation : 2FSK , Mode:66 , 927.6MHz	**Modulation : 2FSK , Mode:98, 927.6MHz**
	

Modulation : O-QPSK , Mode:192, 902.2MHz	Modulation : O-QPSK , Mode:192, 915MHz
	

Modulation : O-QPSK , Mode:192, 927.8MHz



A.1.5 6dB and 99% Occupied Bandwidth (OFDM Modes)

FCC 15.247(a) (2), RSS- 247 5.2(a)

The 99% occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission. There is no limit for 99% OBW.

A.1.5.1 Limit

FCC 15.247(a) (2), RSS- 247 5.2(a)

No Limit is Applicable. 99% OCB is required only for Average Power measurement

The minimum 6 dB bandwidth of a DTS transmission shall be at least 500 kHz.

A.1.5.2 Test Procedure

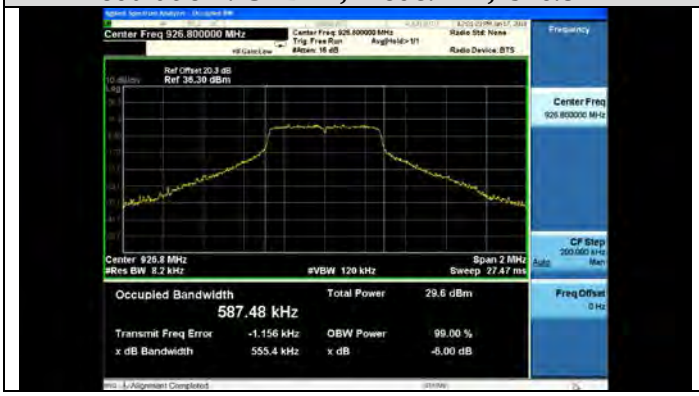
Refer to ANSI C63.10-2013 Clause 6.9.3

- The instrument center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW.
- The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW, and VBW shall be approximately three times the RBW, unless otherwise specified by the applicable requirement.
- Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level.
- Peak detection and max hold mode (until the trace stabilizes) shall be used.
- Use the 99% power bandwidth function of the instrument (if available) and report the measured bandwidth.

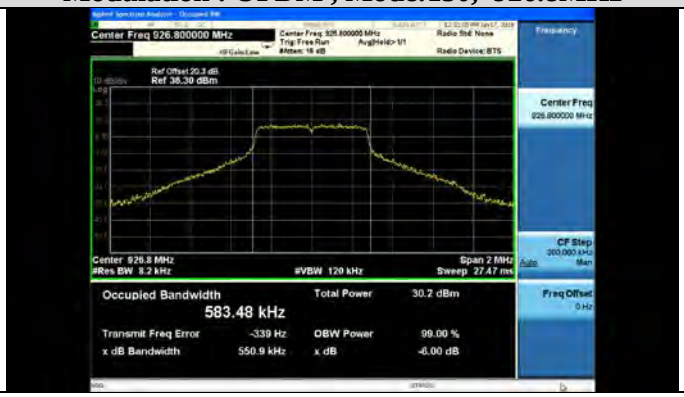
A.1.5.3 6dB & 99% Occupied Bandwidth Data Table

99% Occupied Bandwidth						
Modulation Type	**Phymode**	**Frequency (MHz)**	**Data rate (kbps)**	**Channel Spacing (kHz)**	**99% BW (kHz)**	**6dB BW (kHz)**
OFDM	144	902.8	50	800	610.74	553.4
		914.8			602.55	553.7
		926.8			587.58	555.4
OFDM	146	902.8	200	800	611.43	552.5
		914.8			600.65	555.0
		926.8			587.47	554.3
OFDM	147	902.8	400	800	625.70	555.9
		914.8			603.14	554.1
		926.8			589.10	552.8
OFDM	149	902.8	800	800	603.31	553.9
		914.8			591.34	556.4
		926.8			581.85	552.8
OFDM	150	902.8	1200	800	604.65	551.7
		914.8			595.01	552.7
		926.8			583.48	550.9

A.1.5.4 6dB & 99% Occupied Bandwidth Graphical Test Results (OFDM Modes)

6dB & 99% Ocuupied Bandwidth Results	
Modulation : OFDM , Mode:144 , 902.8MHz	**Modulation : OFDM , Mode:146 , 902.8MHz**
	
Modulation : OFDM , Mode:144 , 914.8MHz	**Modulation : OFDM , Mode:146 , 914.8MHz**
	
Modulation : OFDM , Mode:144 , 926.8MHz	**Modulation : OFDM, Mode:146, 926.8MHz**
	

6dB & 99% Ocuupied Bandwidth Results	
Modulation : OFDM , Mode:147 , 902.8MHz	**Modulation : OFDM , Mode:149 , 902.8MHz**
	
Modulation : OFDM , Mode:147 , 914.8MHz	**Modulation : OFDM , Mode:149, 914.8MHz**
	
Modulation : OFDM , Mode:147 , 926.8MHz	**Modulation : OFDM, Mode:149, 926.8MHz**
	

6dB & 99% Ocuupied Bandwidth Results	
Modulation : OFDM , Mode:150 , 902.8MHz	**Modulation : OFDM , Mode:150 , 914.8MHz**
	
Modulation : OFDM , Mode:150, 926.8MHz	
	

A.2 Maximum Peak Conducted Output Power (2FSK and OQPSK Modes)

FCC 15.247 (b) (3), RSS 247 5.4 (a)
The maximum peak conducted output power is defined as the maximum power level measured with a peak detector using a filter with width and shape of which is sufficient to accept the signal bandwidth. However, when a filter with adequate width is not available, an integrated method utilizing a peak detector is acceptable.

A.2.1 Limits

FCC 15.247 (b) (3)
For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels
RSS 247 5.4 (a)
For FHSs operating in the band 902-928 MHz, the maximum peak conducted output power shall not exceed 1.0 W, and the e.i.r.p. shall not exceed 4 W if the hopset uses 50 or more hopping channels; the maximum peak conducted output power shall not exceed 0.25 W and the e.i.r.p. shall not exceed 1 W if the hopset uses less than 50 hopping channels.

A.2.3 Test Procedure
Refer to ANSI C63.10 Clause 7.8.5

This is an RF-conducted test to evaluate maximum peak output power. Use a direct connection between the antenna port of the unlicensed wireless device and the spectrum analyzer, through suitable attenuation. The hopping shall be disabled for this test:

a) Use the following spectrum analyzer settings:
- Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
- RBW > 20 dB bandwidth of the emission being measured.
- VBW ≥ RBW.
- Sweep: Auto.
- Detector function: Peak.
- Trace: Max hold.

b) Allow trace to stabilize.
c) Use the marker-to-peak function to set the marker to the peak of the emission.
d) The indicated level is the peak output power, after any corrections for external attenuators and cables.
e) A plot of the test results and setup description shall be included in the test report.

A.2.4 Maximum Peak Conducted Output Power Data Table (2FSK and OQPSK Modes)

Modulation	**2FSK**	**Maximum Peak Conducted Output Power & E.I.R.P**				
Mode	64					
Channel Spacing	200kHz					
Data Rate	50kbps					
Frequency (MHz)	**Peak Conducted Output Power (dBm)**	**Peak Conducted Power Limit (dBm)**	**Antenna Gain (dBi)**	**E.I.R.P (dBm)**	**E.I.R.P Limit (dBm)**	**Result**
902.2	**29.272**	**30**	**5.6**	**34.872**	**36**	**Pass**
915.0	28.894	30	5.6	34.494	36	Pass
927.8	28.603	30	5.6	34.203	36	Pass

Modulation	**2FSK**	**Maximum Peak Conducted Output Power & E.I.R.P**				
Mode	96					
Channel Spacing	200kHz					
Data Rate	50kbps					
Frequency (MHz)	**Peak Conducted Output Power (dBm)**	**Peak Conducted Power Limit (dBm)**	**Antenna Gain (dBi)**	**E.I.R.P (dBm)**	**E.I.R.P Limit (dBm)**	**Result**
902.2	29.341	30	5.6	34.941	36	Pass
915.0	28.904	30	5.6	34.504	36	Pass
927.8	28.641	30	5.6	34.241	36	Pass

Note: Worst case is determined as the modulation with Highest Output Power.

Modulation	**2FSK**	**Maximum Peak Conducted Output Power & E.I.R.P**				
Mode	66					
Channel Spacing	400kHz					
Data Rate	150kbps					
Frequency (MHz)	**Peak Conducted Output Power (dBm)**	**Peak Conducted Power Limit (dBm)**	**Antenna Gain (dBi)**	**E.I.R.P (dBm)**	**E.I.R.P Limit (dBm)**	**Result**
902.4	**29.981**	**30**	**5.6**	**35.581**	**36**	**Pass**
915.2	29.630	30	5.6	35.230	36	Pass
927.6	29.328	30	5.6	34.928	36	Pass

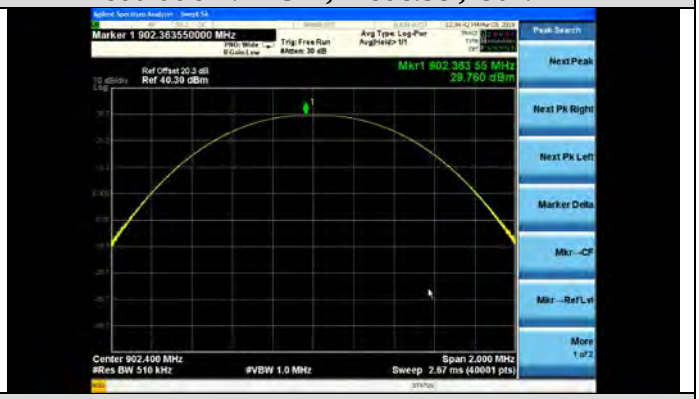
Modulation	**2FSK**	**Maximum Peak Conducted Output Power & E.I.R.P**				
Mode	98					
Channel Spacing	400kHz					
Data Rate	150kbps					
Frequency (MHz)	**Peak Conducted Output Power (dBm)**	**Peak Conducted Power Limit (dBm)**	**Antenna Gain (dBi)**	**E.I.R.P (dBm)**	**E.I.R.P Limit (dBm)**	**Result**
902.4	29.760	30	5.6	35.360	36	Pass
915.2	29.397	30	5.6	34.997	36	Pass
927.6	29.084	30	5.6	34.684	36	Pass

Modulation	**O-QPSK**	**Maximum Peak Conducted Output Power & E.I.R.P**				
Mode	192					
Channel Spacing	200kHz					
Data Rate	6.2kbps					
Frequency (MHz)	**Peak Conducted Output Power (dBm)**	**Peak Conducted Power Limit (dBm)**	**Antenna Gain (dBi)**	**E.I.R.P (dBm)**	**E.I.R.P Limit (dBm)**	**Result**
902.2	29.317	30	5.6	34.917	36	Pass
915.0	28.943	30	5.6	34.543	36	Pass
927.8	28.620	30	5.6	34.220	36	Pass

A.2.5 Maximum Peak Conducted Output Power Graphical Test Results

Maximum Peak Conducted Power Results	
Modulation : 2FSK , Mode:64 , 902.2MHz	**Modulation : 2FSK , Mode:96 , 902.2MHz**
	
Modulation : 2FSK , Mode:64 , 915MHz	**Modulation : 2FSK , Mode:96 , 915MHz**
	
Modulation : 2FSK , Mode:64 , 927.8MHz	**Modulation : 2FSK , Mode:96, 927.8MHz**
	

Maximum Peak Conducted Power Results

Modulation : 2FSK , Mode:66 , 902.4MHz	Modulation : 2FSK , Mode:98 , 902.4MHz
	
Modulation : 2FSK , Mode:66, 915.2MHz	**Modulation : 2FSK , Mode:98, 915.2MHz**
	
Modulation : 2FSK , Mode:66, 927.6MHz	**Modulation : 2FSK , Mode:98, 927.6MHz**
	

Maximum Peak Conducted Power Results	
Modulation : O-QPSK , Mode:192 , 902.2MHz	**Modulation : O-QPSK , Mode:192 , 915MHz**
	
Modulation : O-QPSK, Mode:192, 927.8MHz	
	

A.2.6 Maximum Conducted Output Power (OFDM Modes)

FCC 15.247 (b) (3), RSS 247 5.4 (d)

The maximum conducted output power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level.

A.2.6.1 Limits

FCC 15.247 (b) (3)

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one-Watt limit can be based on a measurement of the maximum conducted output power

RSS 247 5.4 (d)

For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. The e.i.r.p. shall not exceed four Watts

A.2.6.2 Test Procedure

Refer to KDB 558074 D01 DTS Meas Guidance v04 9.2.2.2

(Trace averaging with the EUT transmitting at full power throughout each sweep)

- Set span to at least 1.5 × OBW.
- Set RBW = 1 % to 5 % of the OBW, not to exceed 1 MHz
- Set VBW ≥ 3 × RBW.

- Number of points in sweep ≥ 2 × span / RBW. (This gives bin-to-bin spacing ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)

- Sweep time = auto.
- Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.
- If transmit duty cycle < 98 %, use a sweep trigger with the level set to enable triggering only on full power pulses. The transmitter shall operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle ≥ 98 %, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to “free run”.

- Trace average at least 100 traces in power averaging (i.e., RMS) mode.

- Compute power by integrating the spectrum across the OBW of the signal using the instrument’s band power measurement function, with band limits set equal to the OBW band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

A.2.6.3 Maximum Conducted Output Power Data Table (OFDM Modes)

Modulation	**OFDM**	**Maximum Conducted Output Power & E.I.R.P**				
Mode	144					
Channel Spacing	800kHz					
Data Rate	50kbps					
Frequency (MHz)	**Maximum Conducted Output Power (dBm)**	**Maximum Conducted Power Limit (dBm)**	**Antenna Gain (dBi)**	**E.I.R.P (dBm)**	**E.I.R.P Limit (dBm)**	**Result**
902.8	23.03	30	5.6	28.63	36	Pass
914.8	27.09	30	5.6	32.69	36	Pass
926.8	26.74	30	5.6	32.34	36	Pass

Modulation	**OFDM**	**Maximum Conducted Output Power & E.I.R.P**				
Mode	146					
Channel Spacing	800kHz					
Data Rate	200kbps					
Frequency (MHz)	**Maximum Conducted Output Power (dBm)**	**Maximum Conducted Power Limit (dBm)**	**Antenna Gain (dBi)**	**E.I.R.P (dBm)**	**E.I.R.P Limit (dBm)**	**Result**
902.8	23.01	30	5.6	28.61	36	Pass
914.8	27.12	30	5.6	32.72	36	Pass
926.8	26.70	30	5.6	32.30	36	Pass

Modulation	**OFDM**	**Maximum Conducted Output Power & E.I.R.P**				
Mode	147					
Channel Spacing	800kHz					
Data Rate	400kbps					
Frequency (MHz)	**Maximum Conducted Output Power (dBm)**	**Maximum Conducted Power Limit (dBm)**	**Antenna Gain (dBi)**	**E.I.R.P (dBm)**	**E.I.R.P Limit (dBm)**	**Result**
902.8	23.03	30	5.6	28.63	36	Pass
914.8	26.35	30	5.6	31.95	36	Pass
926.8	25.87	30	5.6	31.47	36	Pass

Modulation	**OFDM**	**Maximum Conducted Output Power & E.I.R.P**				
Mode	149					
Channel Spacing	800kHz					
Data Rate	800kbps					
Frequency (MHz)	**Maximum Conducted Output Power (dBm)**	**Maximum Conducted Power Limit (dBm)**	**Antenna Gain (dBi)**	**E.I.R.P (dBm)**	**E.I.R.P Limit (dBm)**	**Result**
902.8	23.10	30	5.6	28.70	36	Pass
914.8	24.50	30	5.6	30.10	36	Pass
926.8	23.97	30	5.6	29.57	36	Pass

Modulation	**OFDM**	**Maximum Conducted Output Power & E.I.R.P**				
Mode	150					
Channel Spacing	800kHz					
Data Rate	1200kbps					
Frequency (MHz)	**Maximum Conducted Output Power (dBm)**	**Maximum Conducted Power Limit (dBm)**	**Antenna Gain (dBi)**	**E.I.R.P (dBm)**	**E.I.R.P Limit (dBm)**	**Result**
902.8	23.08	30	5.6	28.68	36	Pass
914.8	22.39	30	5.6	27.99	36	Pass
926.8	21.73	30	5.6	27.33	36	Pass

A.2.6.4 Maximum Conducted Output Power Graphical Test Results (OFDM Modes)

Maximum Conducted Power Results	
Modulation : OFDM , Mode:144 , 902.8MHz	**Modulation : OFDM , Mode:146 , 902.8MHz**
	
Modulation : OFDM , Mode:144 , 914.8MHz	**Modulation : OFDM , Mode:146 , 914.8MHz**
	
Modulation : OFDM , Mode:144 , 926.8MHz	**Modulation : OFDM, Mode:146, 926.8MHz**
	

Maximum Conducted Power Results Results	
Modulation : OFDM , Mode:147 , 902.8MHz	**Modulation : OFDM , Mode:149 , 902.8MHz**

Modulation : OFDM , Mode:147 , 914.8MHz

Modulation : OFDM , Mode:149, 914.8MHz

Modulation : OFDM , Mode:147 , 926.8MHz

Modulation : OFDM, Mode:149, 926.8MHz

Maximum Conducted Power Results	
Modulation : OFDM , Mode:150 , 902.8MHz	**Modulation : OFDM , Mode:150 , 914.8MHz**
	
Modulation : OFDM , Mode:150, 926.8MHz	
	

A.3 Power Spectral Density (OFDM Modes)

FCC 15.247(f); RSS-247 5.3(b)
The Power Spectral Density is the total energy output per unit bandwidth from a pulse or sequence of pulses for which the transmit power is at its maximum level, divided by the total duration of the pulses, This total time does not include the time between pulses during which the transmit power is off or below its maximum level.

A.3.1 Limits

FCC 15.247(f); RSS-247 5.3(b)

The power spectral density conducted from the intentional radiator to the antenna due to the digital modulation operation of the hybrid system, with the frequency hopping operation turned off, shall not be greater than eight dBm in any 3 kHz band during any time interval of continuous transmission.

A.3.2 Test Procedure

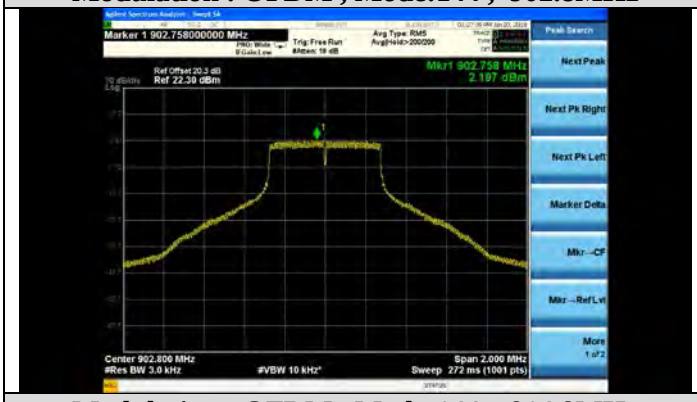
Ref. KDB 558074 DTS Meas Guidance v04 section 10.3

- Set instrument center frequency to DTS channel center frequency.
- Set span to at least 1.5 × OBW.
- Set RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
- Set VBW ≥ 3 × RBW.
- Detector = power averaging (RMS) or sample detector (when RMS not available).
- Ensure that the number of measurement points in the sweep ≥ 2 × span/RBW. g) Sweep time = auto couple.
- Employ trace averaging (RMS) mode over a minimum of 100 traces.
- Use the peak marker function to determine the maximum amplitude level

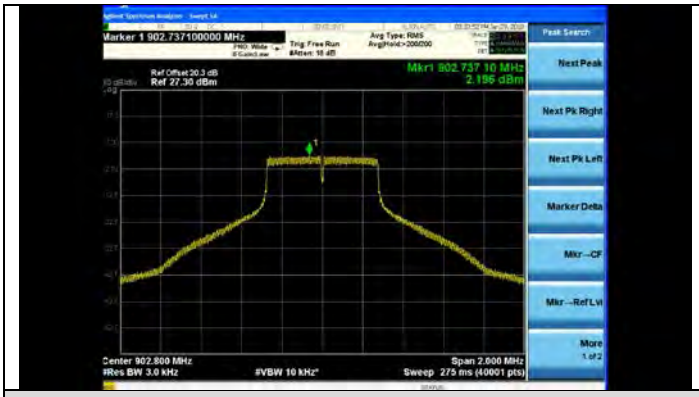
A.3.3 Power Spectral Density Data Table

Power Spectral Density Table						
Modulation Type	**Phymode**	**Frequency (MHz)**	**Data rate (kbps)**	**Channel Spacing (kHz)**	**PSD (dBm/kHz)**	**PSD Limit (8dBm/3kHz)**
OFDM	144	902.8	50	800	2.197	8dBm/3kHz
		914.8			6.333	8dBm/3kHz
		926.8			5.523	8dBm/3kHz
OFDM	146	902.8	200	800	2.023	8dBm/3kHz
		914.8			6.411	8dBm/3kHz
		926.8			5.851	8dBm/3kHz
OFDM	147	902.8	400	800	2.196	8dBm/3kHz
		914.8			5.766	8dBm/3kHz
		926.8			5.072	8dBm/3kHz
OFDM	149	902.8	800	800	2.236	8dBm/3kHz
		914.8			6.407	8dBm/3kHz
		926.8			6.024	8dBm/3kHz
OFDM	150	902.8	1200	800	2.464	8dBm/3kHz
		914.8			1.896	8dBm/3kHz
		926.8			0.811	8dBm/3kHz

A.3.4 Power Spectral Density Graphical test results (OFDM Modes)

Power Spectral Density Results	
Modulation : OFDM , Mode:144 , 902.8MHz	**Modulation : OFDM , Mode:146 , 902.8MHz**
	
Modulation : OFDM , Mode:144 , 914.8MHz	**Modulation : OFDM , Mode:146 , 914.8MHz**
	
Modulation : OFDM , Mode:144 , 926.8MHz	**Modulation : OFDM, Mode:146, 926.8MHz**
	

Power Spectral Density Results	
Modulation : OFDM , Mode:147 , 902.8MHz	**Modulation : OFDM , Mode:149 , 902.8MHz**



Modulation : OFDM , Mode:147 , 914.8MHz

Modulation : OFDM , Mode:149, 914.8MHz

Modulation : OFDM , Mode:147 , 926.8MHz

Modulation : OFDM, Mode:149, 926.8MHz

Power Spectral Density Results	
Modulation : OFDM , Mode:150 , 902.8MHz	**Modulation : OFDM , Mode:150 , 914.8MHz**
	
Modulation : OFDM , Mode:150, 926.8MHz	
	

A.4 Carrier Frequency Separation

A.4.1 Limits

FCC 15.247(a) (1) & & RSS-247 5.1(b)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater

A.4.2 Test Procedure

Refer ANSI C63.10 Section 7.8.2

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

- Span: Wide enough to capture the peaks of two adjacent channels.
- RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
- Video (or average) bandwidth (VBW) ≥ RBW.
- Sweep: Auto.
- Detector function: Peak.
- Trace: Max hold.
- Allow the trace to stabilize.

Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

A.4.3 Carrier Frequency Separation Data Table

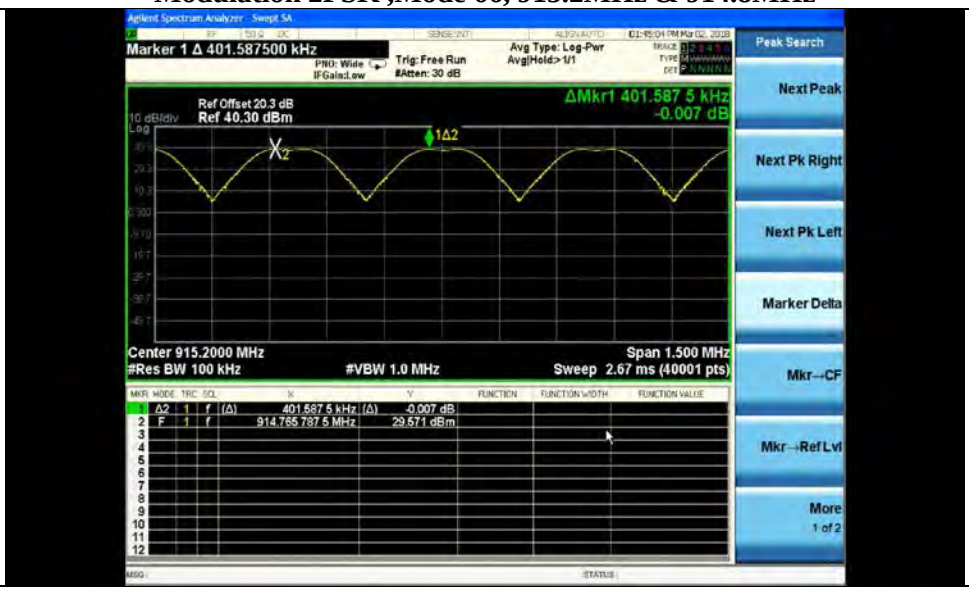
Frequency (MHz)	Modulation Systems	Phymode	Carrier Frequency Separation (kHz)	Limits (kHz) 20db BW	Results
914.8 & 914.6	2FSK	64	200.000	110.7	Pass
915.0 & 914.8	2FSK	96	200.000	110.3	Pass
915.2 & 914.8	2FSK	66	401.587	195.0	Pass
915.2 & 914.8	2FSK	98	474.475	194.0	Pass

A.4.4 Carrier Frequency Separation Graphical Results

Modulation 2FSK ,Mode 64 , 915MHz & 915.2MHz

Modulation 2FSK ,Mode 96 , 914.8MHz & 915MHz

Modulation 2FSK ,Mode 66, 915.2MHz & 914.8MHz



Modulation 2FSK ,Mode 98, 915.2MHz & 914.8MHz

Modulation O-QPSK ,Mode 192 , 915MHz & 915.2MHz


A.5 Number of Hopping Frequencies

A.5.1 Limits

FCC 15.247(a) (1) (i) & RSS-247 (5.1) (c)

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies

A.5.2 Test Procedures

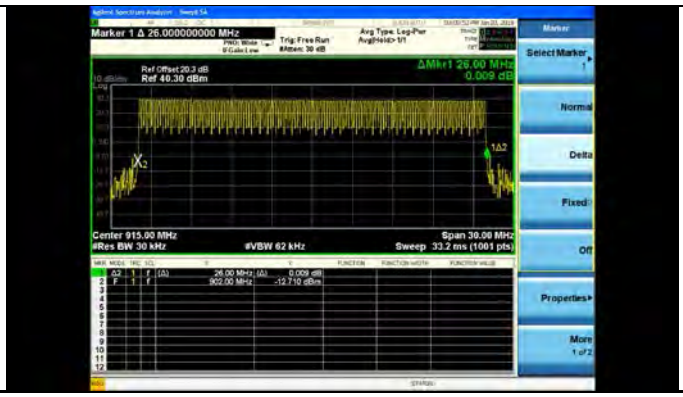
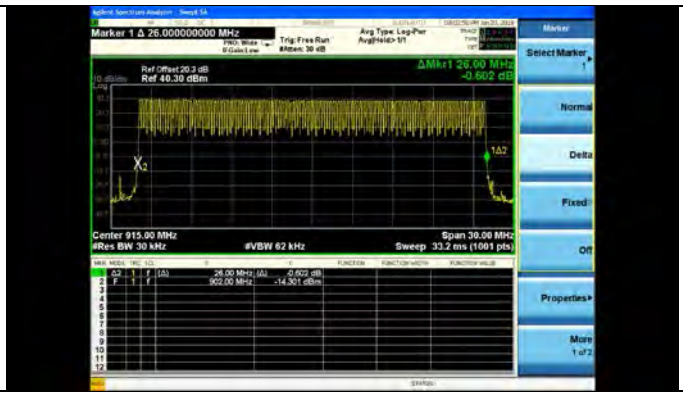
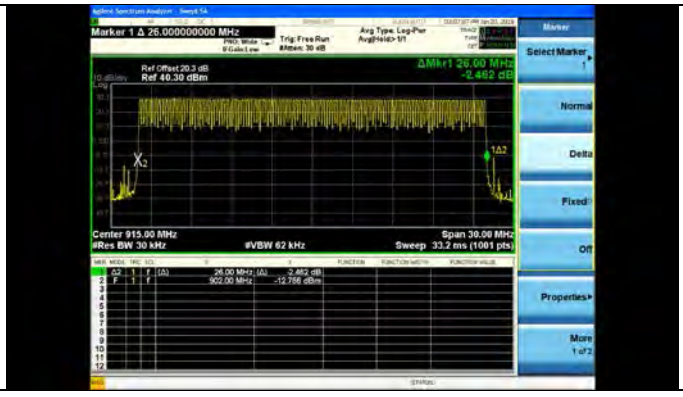
Refer ANSI C63.10 Section 7.8.3
The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

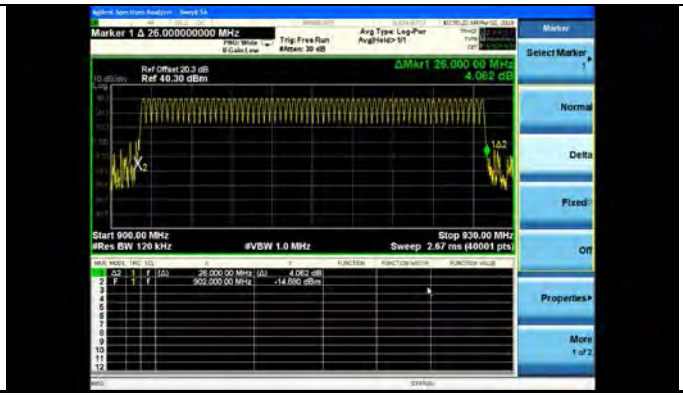
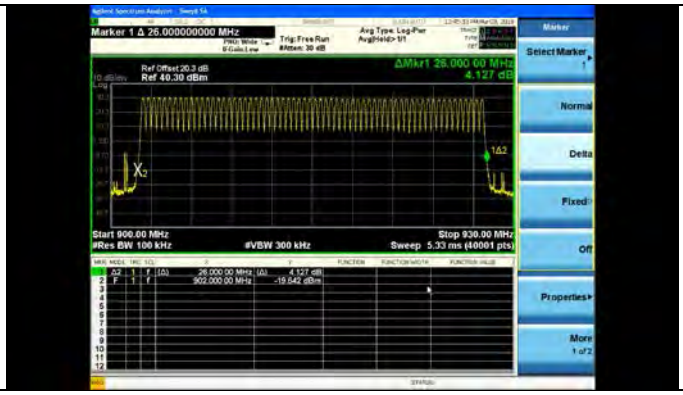
- Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
- RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
- VBW ≥ RBW.
- Sweep: Auto.
- Detector function: Peak.
- Trace: Max hold.
- Allow the trace to stabilize.

A.5.3 Number of Hopping Frequencies Data Table

Frequency (MHz)	Total No. of Channels	Limits	Results
902-928	129	≥ 50	Pass
902-928	64	≥ 50	Pass
Total number of hopping frequencies in the 902-928MHz Band = 129 Channels (2FSK,OQPSK) Total number of hopping frequencies in the 902-928MHz Band = 64 Channels (2FSK with 400kHz Channel spacing)			

A.4.3 Number of Hopping Frequencies Graphical Test Results

Modulation 2FSK ,Mode 64

Modulation 2FSK ,Mode 96

Modulation O-QPSK ,Mode 192


Modulation 2FSK ,Mode 66

Modulation 2FSK ,Mode 98


A.5 Average Time of Occupancy (2FSK and OQPSK Modes)

A.5.1 Limits

FCC 15.247 (a) (1) (i) & RSS-247 (5.1) (c)

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20-second period.

A.5.2 Test Procedure

Refer to ANSI C63.10 7.8.4
The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

- Span: Zero span, centered on a hopping channel.
- RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.
- Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
- Detector function: Peak.
- Trace: Max hold.

Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.

Modulation Type : 2FSK , Mode 64, 50kbps	
Measured time of occupancy (dwell time) for one total transmission =	138.2 ms
Time Frame = 0.4 s * 50 hopping channels =	20000 ms
Measured time to return to one channel =	17820 ms
Total transmit events for one channel in the Time Frame, 20000 ms / 17820 ms =	1.122 events
Total time that one channel transmits within the 20 s Time Frame = 1.122 * 138.2 ms =	**155.0604 ms**

Modulation Type : 2FSK , Mode 96, 50kbps	
Measured time of occupancy (dwell time) for one total transmission =	138.3 ms
Time Frame = 0.4 s * 50 hopping channels =	20000 ms
Measured time to return to one channel =	17820 ms
Total transmit events for one channel in the Time Frame, 20000 ms / 17820 ms =	1.122 events
Total time that one channel transmits within the 20 s Time Frame = 1.122 * 138.3 ms =	**168.726 ms**

Modulation Type : 2FSK , Mode 66, 150kbps	
Measured time of occupancy (dwell time) for one total transmission =	136.4 ms
Time Frame = 0.4 s * 50 hopping channels =	20000 ms
Measured time to return to one channel =	8800 ms
Total transmit events for one channel in the Time Frame, 20000 ms / 8800 ms =	2.28 events
Total time that one channel transmits within the 20 s Time Frame = 2.28 * 136.4 ms =	**310.992 ms**

Modulation Type : 2FSK , Mode 98, 150kbps	
Measured time of occupancy (dwell time) for one total transmission =	137.5 ms
Time Frame = 0.4 s * 50 hopping channels =	20000 ms
Measured time to return to one channel =	8783 ms
Total transmit events for one channel in the Time Frame, 20000 ms / 8783 ms =	2.277 events
Total time that one channel transmits within the 20 s Time Frame = 2.277 * 137.5 ms =	**313.0875 ms**

Modulation Type : O-QPSK , Mode 192, 6.2kbps	
Measured time of occupancy (dwell time) for one total transmission =	138 ms
Time Frame = 0.4 s * 50 hopping channels =	20000 ms
Measured time to return to one channel =	17820 ms
Total transmit events for one channel in the Time Frame, 20000 ms / 17820 ms =	1.122 events
Total time that one channel transmits within the 20 s Time Frame = 1.122 * 138 ms =	**154 ms**

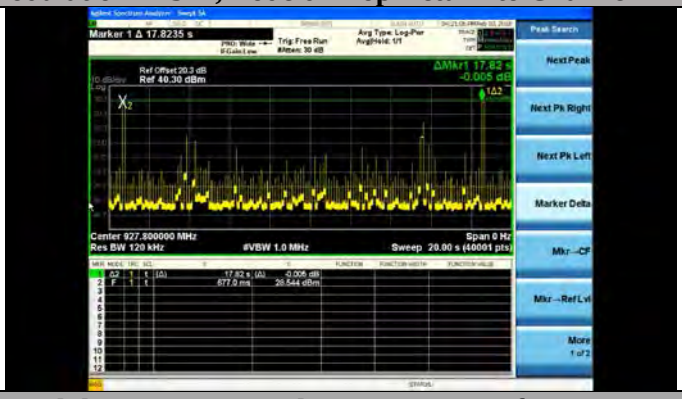
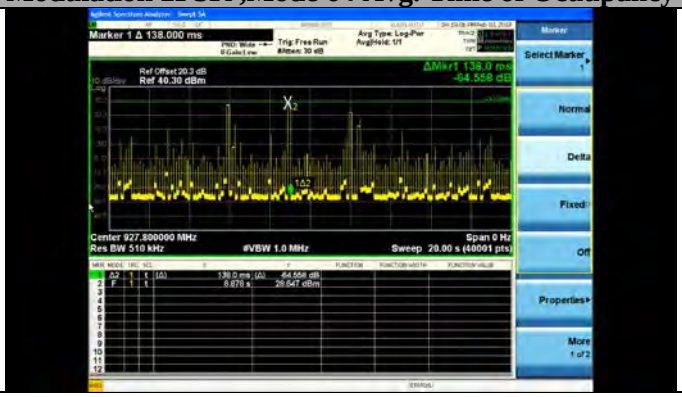
A.5.3 Average Time of Occupancy and Dwell time Data table

Modulation Type	Phymode	Dwell Time	Time Occupancy	Limits (ms)	Results

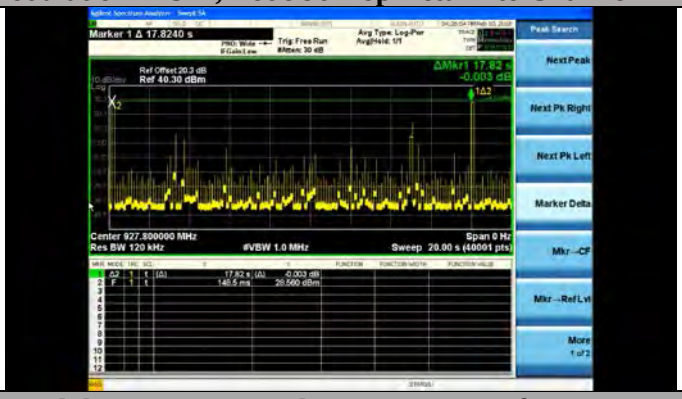
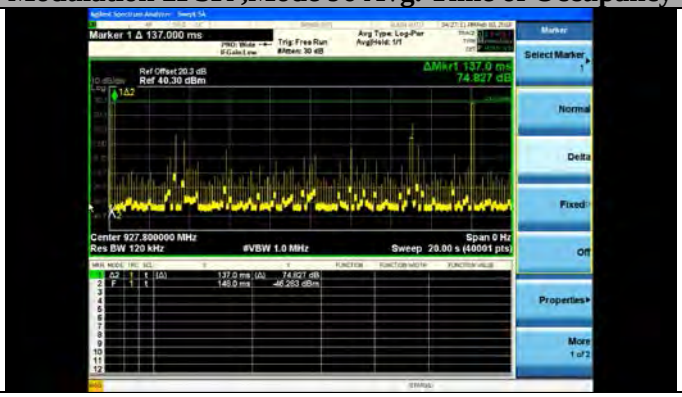
		(ms)	(ms)		
2FSK	64	138.2	155	400	Pass
2FSK	96	138.3	168	400	Pass
2FSK	66	136.4	310	400	Pass
2FSK	98	137.5	313	400	Pass
Q-QPSK	192	138.0	154	400	Pass

A.5.4 Average Time of Occupancy and Dwell Time Graphical Test Results

Dwell Time & Frequency Occupation Time
Modulation 2FSK ,Mode 64 Dwell time

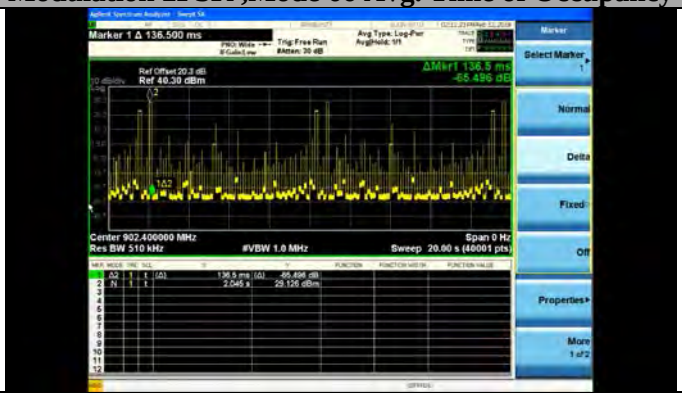
Modulation 2FSK ,Mode 64 Hop Return to Channel Time

Modulation 2FSK ,Mode 64 Avg. Time of Ocuupancy


Dwell Time & Frequency Occupation Time
Modulation 2FSK ,Mode 96 Dwell time

Modulation 2FSK ,Mode 96 Hop Return to Channel Time

Modulation 2FSK ,Mode 96 Avg. Time of Occupancy


Dwell Time & Frequency Occupation Time
Modulation 2FSK ,Mode 66 Dwell time

Modulation 2FSK ,Mode 66 Hop Return to Channel Time

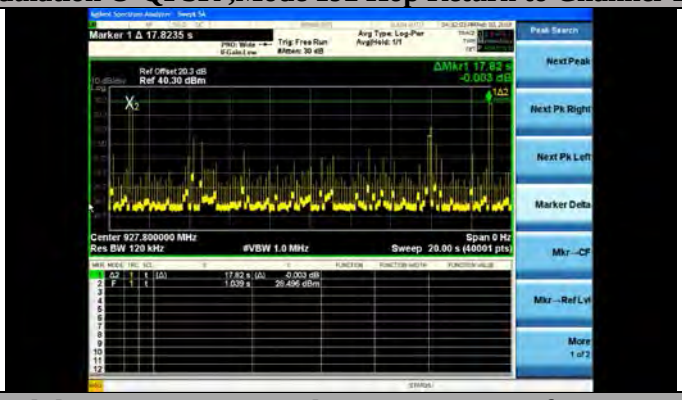
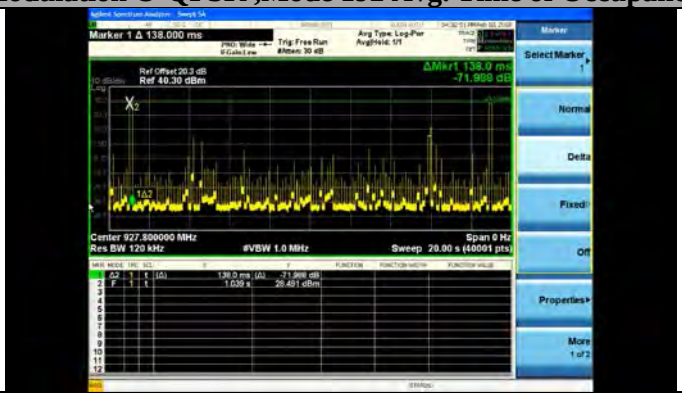
Modulation 2FSK ,Mode 66 Avg. Time of Occupancy


Dwell Time & Frequency Occupation Time
Modulation 2FSK ,Mode 98 Dwell time

Modulation 2FSK ,Mode 98 Hop Return to Channel Time

Modulation 2FSK ,Mode 98 Avg. Time of Occupancy


Dwell Time & Frequency Occupation Time
Modulation O-QPSK ,Mode 192 Dwell time

Modulation O-QPSK ,Mode 192 Hop Return to Channel Time

Modulation O-QPSK ,Mode 192 Avg. Time of Occupancy


A.5.5 Average Time of Occupancy (OFDM Modes)

A.5.5.1 Limits

FCC 15.247 (f) & RSS-247 (5.3) (a)

The frequency hopping operation of the hybrid system, with the direct sequence or digital modulation operation turned-off, shall have an average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4

A.5.5.2 Test Procedure

Refer to ANSI C63.10 7.8.4
The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

- Span: Zero span, centered on a hopping channel.
- RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.
- Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
- Detector function: Peak.
- Trace: Max hold.

Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.

Average Time of Occupancy and Dwell Time Calculations

Modulation Type : OFDM , Mode 144	
Measured time of occupancy (dwell time) for one total transmission =	137 ms
Time Frame = 0.4 s * 31 hopping channels =	12400 ms
Measured time to return to one channel =	4267 ms
Total transmit events for one channel in the Time Frame, 12400 ms / 4267 ms =	2.906 events
Total time that one channel transmits within the 20 s Time Frame = 2.906 * 137 ms =	**398.122 ms**

Modulation Type : OFDM , Mode 146	
Measured time of occupancy (dwell time) for one total transmission =	137 ms
Time Frame = 0.4 s * 31 hopping channels =	12400 ms
Measured time to return to one channel =	4267 ms
Total transmit events for one channel in the Time Frame, 12400 ms / 4267 ms =	2.906 events
Total time that one channel transmits within the 20 s Time Frame = 2.906 * 137 ms =	**398.122 ms**

Modulation Type : OFDM , Mode 147	
Measured time of occupancy (dwell time) for one total transmission =	136.6 ms
Time Frame = 0.4 s * 31 hopping channels =	12400 ms
Measured time to return to one channel =	4242 ms
Total transmit events for one channel in the Time Frame, 12400 ms / 4242 ms =	2.923 events
Total time that one channel transmits within the 20 s Time Frame = 2.923 * 136.6 ms =	**399. 281 ms**

Modulation Type : OFDM , Mode 149	
Measured time of occupancy (dwell time) for one total transmission =	137 ms
Time Frame = 0.4 s * 31 hopping channels =	12400 ms
Measured time to return to one channel =	4287 ms
Total transmit events for one channel in the Time Frame, 12400 ms / 4287 ms =	2.892 events
Total time that one channel transmits within the 20 s Time Frame = 2.892 * 137 ms =	**396. 204 ms**

Modulation Type : OFDM , Mode 150	
Measured time of occupancy (dwell time) for one total transmission =	137 ms
Time Frame = 0.4 s * 31 hopping channels =	12400 ms
Measured time to return to one channel =	4287 ms
Total transmit events for one channel in the Time Frame, 12400 ms / 4287 ms =	2.892 events
Total time that one channel transmits within the 20 s Time Frame = 2.892 * 137 ms =	**396. 204 ms**

A.5.5.3 Average Time of Occupancy and Dwell time Data table

Modulation Type	Phymode	Dwell Time (ms)	Time Occupancy (ms)	Limits (ms)	Results
OFDM	144	137	398	400	Pass
OFDM	146	137	398	400	Pass
OFDM	147	136.6	399	400	Pass
OFDM	149	137	396	400	Pass
OFDM	150	137	396	400	Pass

A.5.5.4 Average Time of Occupancy and Dwell Time Graphical Test Results

Dwell Time & Frequency Occupation Time
Modulation OFDM ,Mode 144 Dwell time

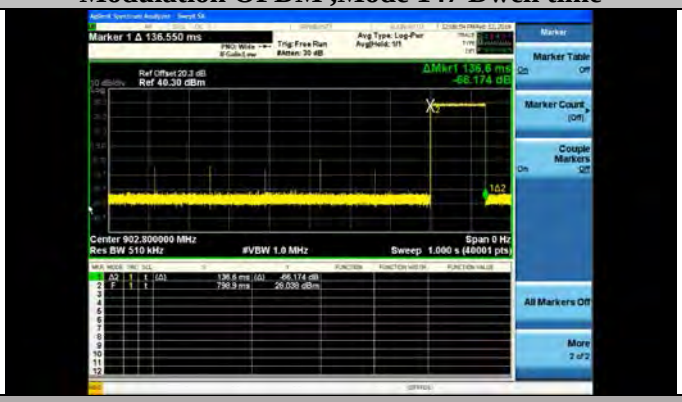
Modulation OFDM ,Mode 144 Hop Return to Channel Time

Modulation OFDM ,Mode 144 Avg. Time of Occupancy


Dwell Time & Frequency Occupation Time
Modulation OFDM ,Mode 146 Dwell time

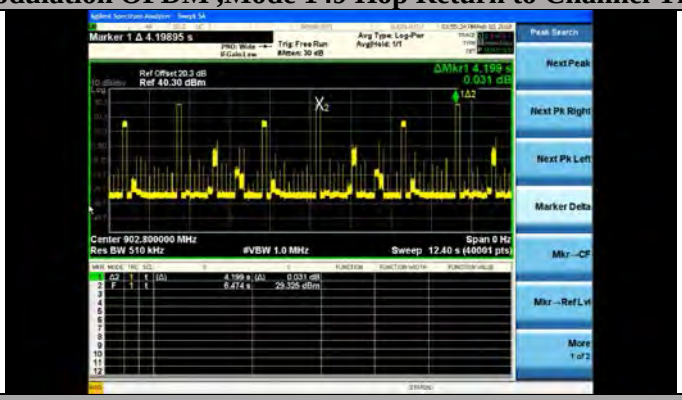
Modulation OFDM ,Mode 146 Hop Return to Channel Time

Modulation OFDM ,Mode 146 Avg. Time of Occupancy

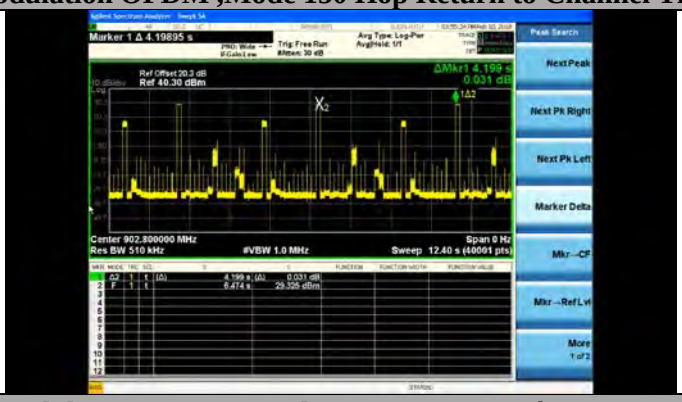

Dwell Time & Frequency Occupation Time
Modulation OFDM ,Mode 147 Dwell time

Modulation OFDM ,Mode 147 Hop Return to Channel Time

Modulation OFDM ,Mode 147 Avg. Time of Occupancy


Dwell Time & Frequency Occupation Time
Modulation OFDM ,Mode 149 Dwell time

Modulation OFDM ,Mode 149 Hop Return to Channel Time

Modulation OFDM ,Mode 149 Avg. Time of Occupancy


Dwell Time & Frequency Occupation Time
Modulation OFDM ,Mode 150 Dwell time

Modulation OFDM ,Mode 150 Hop Return to Channel Time

Modulation OFDM ,Mode 150 Avg. Time of Occupancy


A.6 Conducted Band Edge Measurements

A.6.1 Limits

15.247 (d) & RSS-247 (5.5)

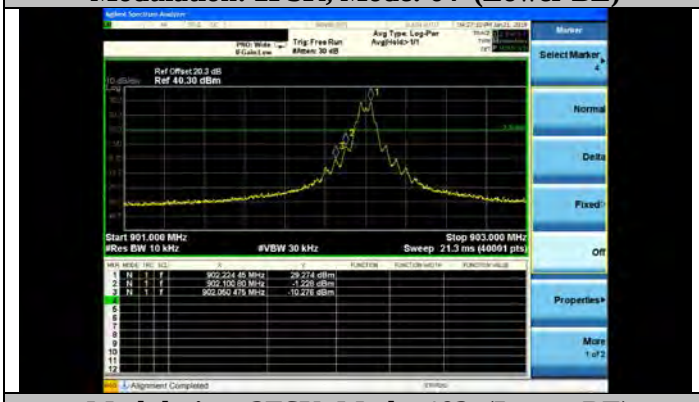
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in FCC §15.209(a) & RSS-Gen is not required.

A.6.2 Test Procedure

Refer to Public notice DA-00 705

- Use the following spectrum analyzer settings:
- Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation
- RBW ≥ 1% of the span
- VBW ≥ RBW
- Sweep = auto
- Detector function = peak
- Trace = max hold
- Allow the trace to stabilize. Set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge. Enable the marker-delta function, and then use the marker-to-peak function to move the marker to the peak of the in-band emission. The marker-delta value now displayed must comply with the limit specified in this Section. Submit this plot.
- Now, using the same instrument settings, enable the hopping function of the EUT. Allow the trace to stabilize. Follow the same procedure listed above to determine if any spurious emissions caused by the hopping function also comply with the specified limit. Submit this plot.

A.6.3 Conducted Band Edge Graphical Test Results (2FSK and OQPSK 20dBc)

Conducted Band Edge (Hoping Disable)	
Modulation: 2FSK, Mode: 64 (Lower BE)	**Modulation: 2FSK, Mode: 64 (Higher BE)**
	
Modulation: 2FSK, Mode: 192 (Lower BE)	**Modulation: 2FSK, Mode: 192 (Higher BE)**
	
Modulation: 2FSK, Mode: 66 (Lower BE)	**Modulation: 2FSK, Mode: 66 (Higher BE)**
	

Note: Mode 64 and 96 represents identical mode except Forward error correction ON for mode 64 and off for mode 96. Similarly, Mode 66 and 98 represent identical mode. So band edge data can be used for one another

Conducted Band Edge (Hoping Enable)	
Modulation: 2FSK, Mode: 64 (Lower BE)	**Modulation: 2FSK, Mode: 64 (Higher BE)**

Modulation: 2FSK, Mode: 96 (Lower BE)

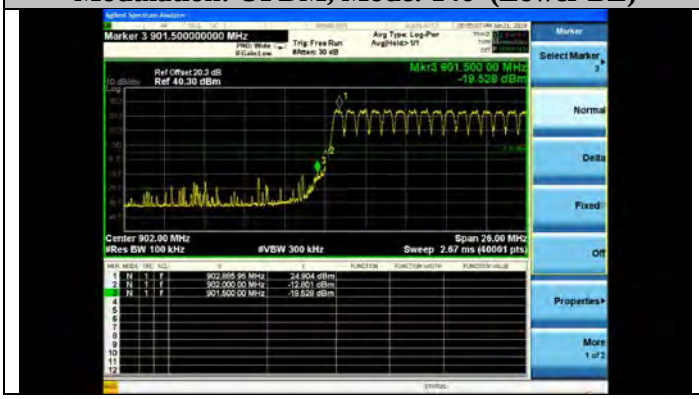
Modulation: 2FSK, Mode: 96(Higher BE)

Modulation: 2FSK, Mode: 66 (Lower BE)

Modulation: 2FSK, Mode: 66 (Higher BE)

A.6.4 Conducted Band Edge Graphical Test Results (OFDM Modes 30dBc)

Conducted Band Edge (Hoping Disable)	
Modulation: OFDM, Mode: 146 (Lower BE)	**Modulation: OFDM, Mode: 146 (Higher BE)**
	

Conducted Band Edge (Hoping Enable)	
Modulation: OFDM, Mode: 146 (Lower BE)	**Modulation: OFDM, Mode: 146 (Higher BE)**
	

Note: All the OFDM Modes have same channel spacing of 800 kHz and therefore only Mode with Highest power have been shown here and rest of the modes represents the same results

A.7 Emissions in Non-Restricted Bands

A.7.1 Limits

15.247 (d) & RSS-247 (5.5)
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in FCC §15.209(a) & RSS-Gen is not required.

A.7.2 Test Procedure

Ref. 558074 D01 DTS Meas Guidance v04 Section 11.2

Reference Level Measurement:

Establish a reference level by using the following procedure:

- Set instrument center frequency to DTS channel center frequency.
- Set the span to ≥ 1.5 × DTS bandwidth.
- Set the RBW = 100 kHz.
- Set the VBW ≥ 3 × RBW.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum PSD level.

Note that the channel found to contain the maximum PSD level can be used to establish the reference level.

Emission level measurement

- Set the center frequency and span to encompass frequency range to be measured.
- Set the RBW = 100 kHz.
- Set the VBW ≥ 3 × RBW.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band. Report the three highest emissions relative to the limit.

Note: Mode 66 represents worst-case mode for 2FSK Modulations
Mode 192 represents worst-case mode for OQPSK Modulations
Mode 146 represents worst-case mode for OFDM Modulations

A.7.3 Emissions in Non-Restricted Bands Results (2FSK and OQPSK Modes 20dBc)

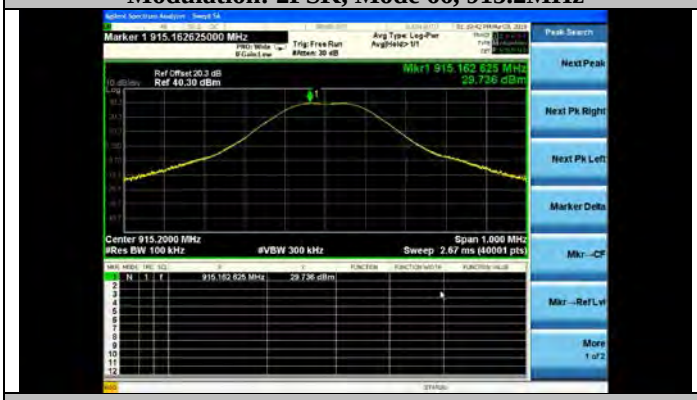
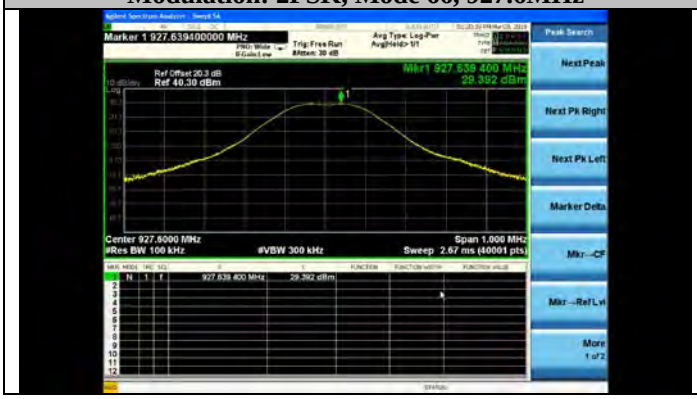
Frequency (MHz)	Mode	Reference Level (dBm)	Data Rate (Kbps)	Highest Emissions (dBm)	Limit (20dBc)	Margin (dB)
Mode 66 2FSK	902.4MHz	30.09	150.00	-25.605	10.09	35.695
	915.2MHz	30.09	150.00	-26.383	10.09	36.473
	927.6MHz	30.09	150.00	-27.657	10.09	37.666

Frequency (MHz)	Mode	Reference Level (dBm)	Data Rate (Kbps)	Highest Emissions (dBm)	Limit (20dBc)	Margin (dB)
Mode 192 OQPSK	902.2MHz	29.550	6.2	-26.039	9.550	35.589
	915.0MHz	28.973	6.2	-26.912	9.550	36.462
	927.8MHz	28.650	6.2	-28.805	9.550	38.355

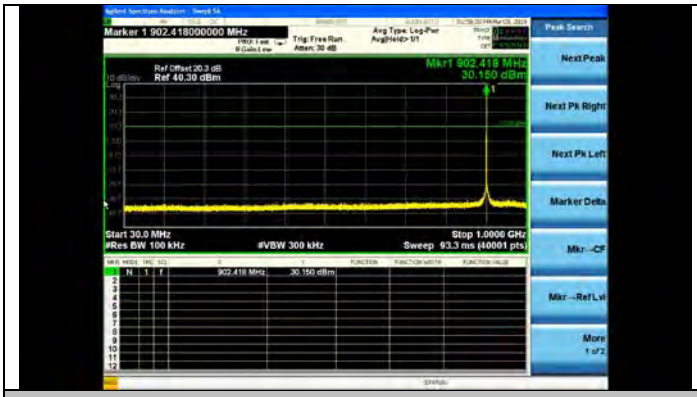
Emissions in non-Restricted Bands Results (OFDM Mode 30dBc)

Frequency (MHz)	Mode	Reference Level (dBm)	Data Rate (Kbps)	Highest Emissions (dBm)	Limit (30dBc)	Margin (dB)
Mode 146 OFDM	902.8MHz	25.120	200	-35.281	-1.654	33.627
	914.8MHz	28.346	200	-30.607	-1.654	28.953
	926.8MHz	27.948	200	-32.194	-1.654	30.540

A.7.4 Emissions in Non-Restricted Bands Test Results (2FSK and OQPSK Modes 20dBc)

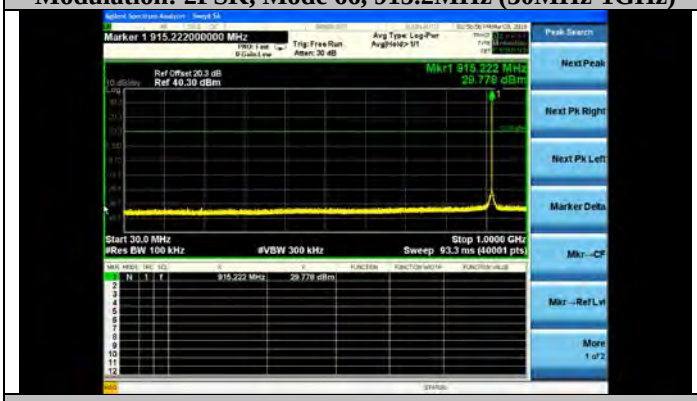
Reference level measurement	
Modulation: 2FSK, Mode 66, 902.4MHz	**Modulation: OQPSK, Mode 192, 902.2MHz**
	
Modulation: 2FSK, Mode 66, 915.2MHz	**Modulation: OQPSK, Mode 192, 914.8MHz**
	
Modulation: 2FSK, Mode 66, 927.6MHz	**Modulation: OQPSK, Mode 192, 927.8MHz**
	

Emissions level measurement	
Modulation: 2FSK, Mode 66, 902.4MHz (30MHz-1GHz)	**Modulation: 2FSK, Mode 66, 902.4MHz (1-10GHz)**

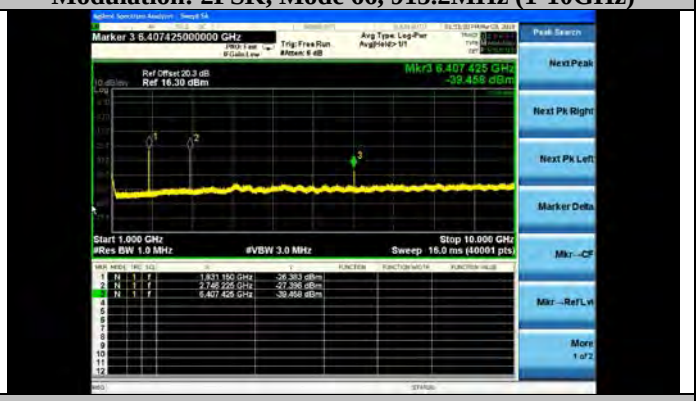


Modulation: 2FSK, Mode 66, 915.2MHz (30MHz-1GHz)

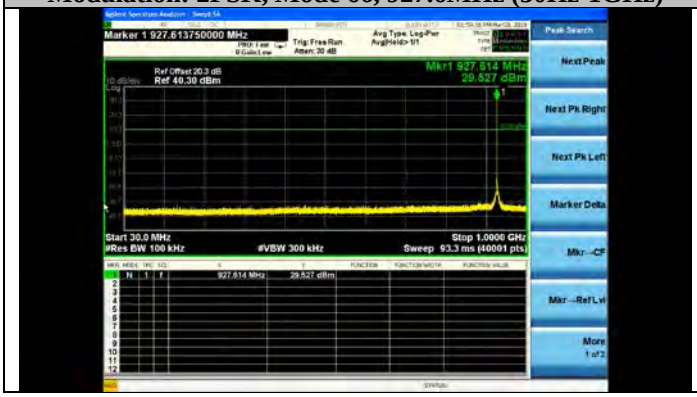
Modulation: 2FSK, Mode 66, 915.2MHz (1-10GHz)

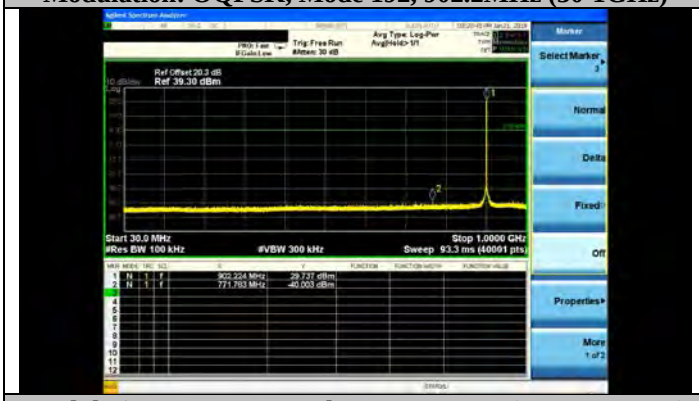


Modulation: 2FSK, Mode 66, 927.6MHz (30Hz-1GHz)

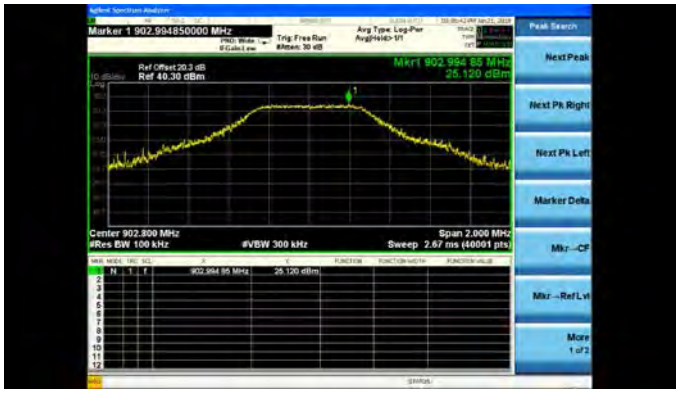


Modulation: 2FSK, Mode 66, 927.6MHz (1-10GHz)

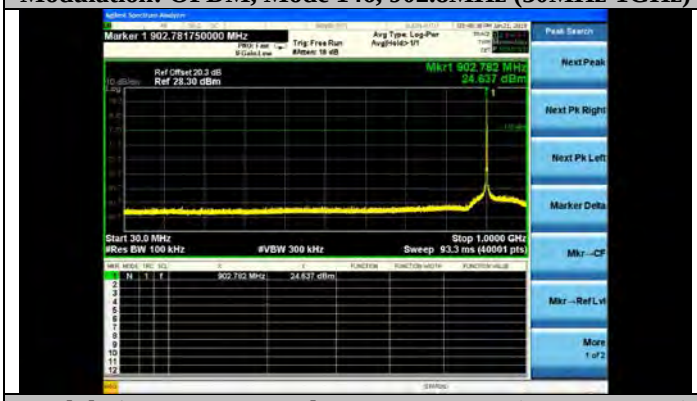
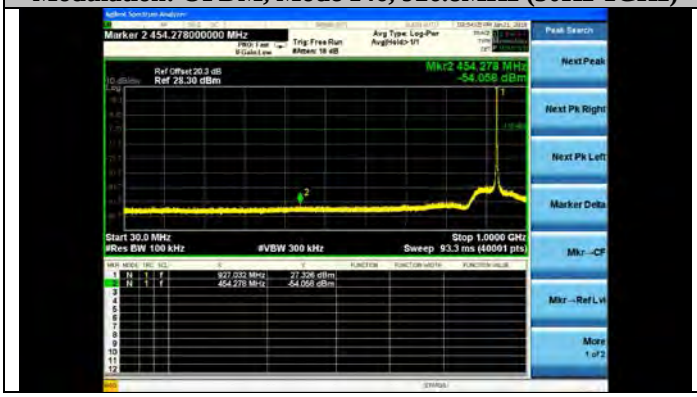


Emissions level measurement	
Modulation: OQPSK, Mode 192, 902.2MHz (30-1GHz)	**Modulation: OQPSK, Mode 192, 902.2MHz (1-10GHz)**
	
Modulation: OQPSK, Mode 192, 915MHz (30MHz-1GHz)	**Modulation: OQPSK, Mode 192, 915MHz (1-10GHz)**
	
Modulation: OQPSK, Mode 192, 927.8MHz (30-1GHz)	**Modulation: OQPSK, Mode 192, 927.8MHz (1-10GHz)**
	

A.7.5 Emissions in non - Restricted Bands Graphical Test Results (OFDM Modes 30dBc)

Reference level measurement
Modulation: OFDM, Mode 146, 902.8MHz

Modulation: OFDM, Mode 146, 914.8MHz

Modulation: OFDM, Mode 146, 926.8MHz


Emissions level measurement	
Modulation: OFDM, Mode 146, 902.8MHz (30MHz-1GHz)	**Modulation: OFDM, Mode 146, 902.8MHz (1-10GHz)**
	
Modulation: OFDM, Mode 146, 914.8MHz (30MHz-1GHz)	**Modulation: OFDM, Mode 192, 915MHz (1-10GHz)**
	
Modulation: OFDM, Mode 146, 926.8MHz (30Hz-1GHz)	**Modulation: OFDM, Mode 146, 926.8MHz (1-10GHz)**
	

- 2nd Harmonics of all three channels falls under non-restricted bands and so limit of 20dBc satisfies
- Third Harmonics of all three channels falls under restricted bands so general limit of 15.209 needs to be satisfied. This is demonstrated in next section
- Sixth Harmonics of Channel 0 falls under restricted band so general limit of -41.2 and -21.2 Avg and peak respectively needs to be satisfied. This is demonstrated in next section
- 6th Harmonics of middle channel and last channel doesn't fall under restricted bands so limit of 20dBc needs to be satisfies

A.8 Emissions in Restricted Bands

A.8.1 Limits

FCC 15.247(e); RSS-Gen 7.2.2(b)

FCC: Radiated emissions, which fall in the restricted bands, as, defined in FCC §15.205(a), must also comply with the radiated emission limits specified in Sec. 15.209(a).

RSS: Unwanted emissions falling into restricted bands of Table 6 shall comply with the limits specified in RSS-Gen

A.8.2 Test Procedure

Refer to ANSI C63.10-2013 Section 12.2

Peak Power measurement procedure:
Peak emission levels are measured by setting the instrument as follows:

- RBW = 100 kHz for below 1GHz and 1MHz for above 1GHz.
- VBW ≥ 3 × RBW.
- Detector = Peak.
- Sweep time = auto.
- Trace mode = max hold.
- Allow sweeps to continue until the trace stabilizes. (Note that the required measurement time may be longer for low duty cycle applications).

Average Power measurement procedure:
If the EUT can be configured or modified to transmit continuously (duty cycle ≥ 98 % then the average emission levels shall be measured using the following method (with EUT transmitting continuously).

- RBW = 1 MHz (unless otherwise specified).
- VBW ≥ 3 × RBW.
- Detector = RMS, if span/(# of points in sweep) ≤ (RBW/2). Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set to peak.
- Averaging type = power (i.e., RMS).
  - As an alternative, the detector and averaging type may be set for linear voltage averaging.
  - Some instruments require linear display mode in order to use linear voltage averaging. Log or dB averaging shall not be used.
- Sweep time = auto.
  Perform a trace average of at least 100 traces.

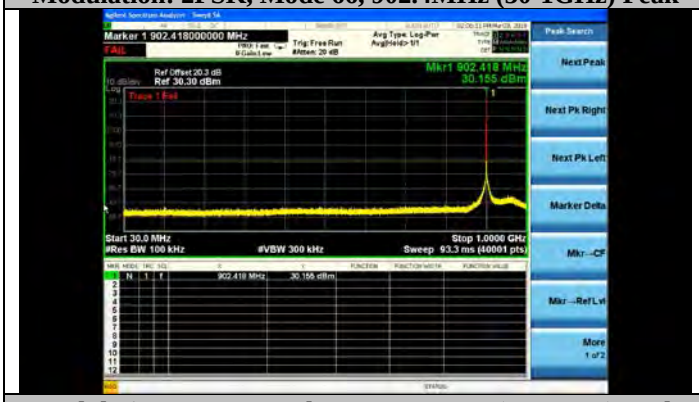
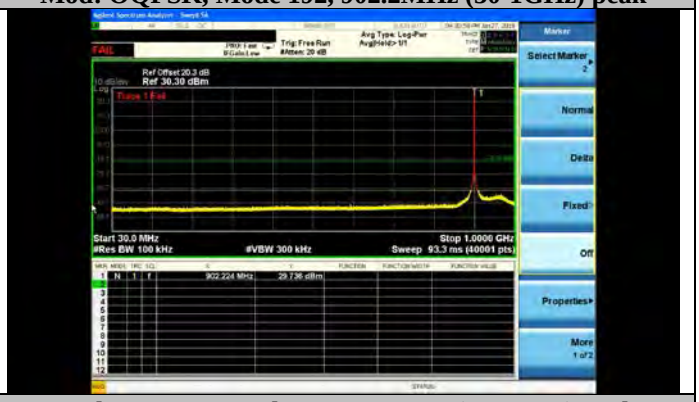
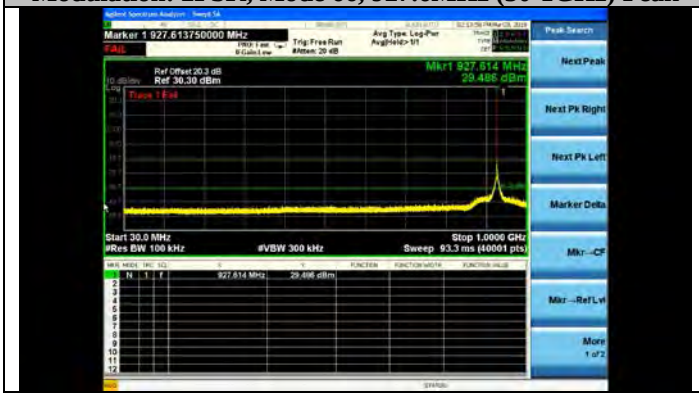
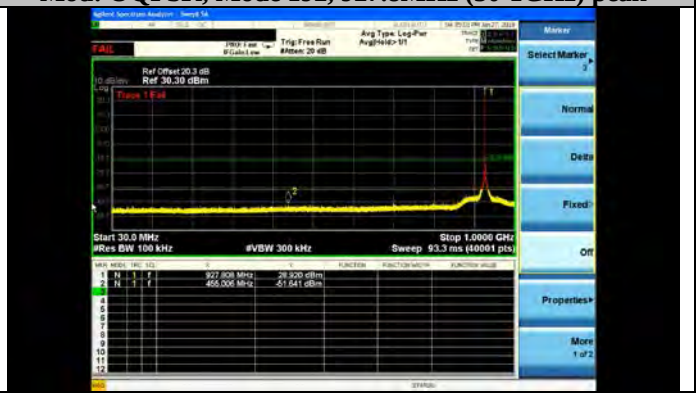
A.8.3 Emissions in Restricted Bands Results (2FSK and OQPSK)

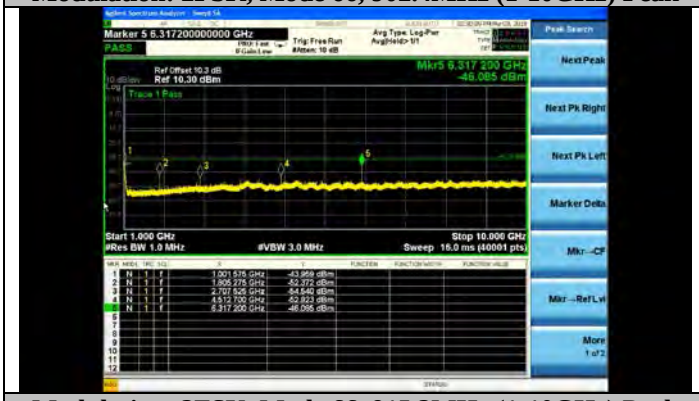
Frequency (MHz)	Data Rate (kbps)	A.G (dBi)	Restricted Bands (MHz)	Max. Emissions Level (dBm)	E.I.R.P (dBm)	Limit (dBm)	Result
Mode 66: 2FSK							
902.4	**150**	5.6	2600–2900	-54.540	-48.940	-21.2	Pass
			2600-2900	-58.526	-52.926	-41.2	Pass
		5.6	4500-5150	-52.923	-47.323	-21.2	Pass
			4500-5150	**-57.348**	**-51.748**	-41.2	Pass
915.2	**150**	5.6	2600–2900	-54.681	-49.081	-21.2	Pass
			2600-2900	-59.149	-53.549	-41.2	**Pass**
		5.6	4500-5150	-52.626	-47.026	-21.2	Pass
			4500-5150	**-58.854**	**-53.254**	-41.2	Pass
927.6	**150**	5.6	2600–2900	-50.035	-44.435	-21.2	Pass
			2600-2900	**-49.827**	**-44.227**	**-41.2**	**Pass**
		5.6	4500-5150	-50.129	-44.529	-21.2	Pass
			4500-5150	-53.926	-48.326	-41.2	Pass

Mode 192: OQPSK							
902.2	**6.2**	5.6	2600–2900	-50.395	-44.795	-21.2	Pass
			2600-2900	**-53.295**	**-47.695**	**-41.2**	**Pass**
		5.6	4500-5150	-54.440	-48.840	-21.2	Pass
			4500-5150	-59.566	-53.966	-41.2	Pass
915.0	**6.2**	5.6	2600–2900	-51.131	-45.531	-21.2	Pass
			2600-2900	**-54.373**	**-48.773**	**-41.2**	**Pass**
		5.6	4500-5150	-52.614	-47.014	-21.2	Pass
			4500-5150	-57.173	-51.573	-41.2	Pass
927.8	**6.2**	5.6	2600–2900	-52.756	-47.156	-21.2	Pass
			2600-2900	**-56.225**	**-50.625**	**-41.2**	**Pass**
		5.6	4500-5150	-53.828	-48.228	-21.2	Pass
			4500-5150	-58.868	-53.268	-41.2	Pass

Mode 146: OFDM							
902.8	**200**	5.6	2600–2900	-55.155	-49.555	-21.2	Pass
			2600-2900	**-64.787**	**-59.187**	**-41.2**	**Pass**
		5.6	5350-5460	-53.421	-47.821	-21.2	Pass
			5350-5460	-63.575	-57.975	-41.2	Pass
914.8	**200**	5.6	2600–2900	-51.321	-45.721	-21.2	Pass
			2600-2900	-57.532	-51.932	-41.2	Pass
		5.6	4500-5150	-52.935	-47.335	-21.2	Pass
			4500-5150	**-60.280**	**-54.680**	**-41.2**	**Pass**
926.8	**200**	5.6	2600–2900	-52.476	-46.876	-21.2	Pass
			2600-2900	-59.393	-53.793	-41.2	Pass
		5.6	4500-5150	-53.945	-48.345	-21.2	Pass
			4500-5150	**-62.291**	**-56.691**	**-41.2**	**Pass**

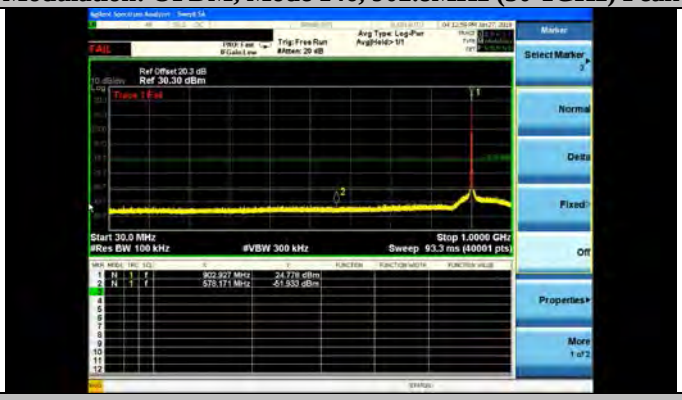
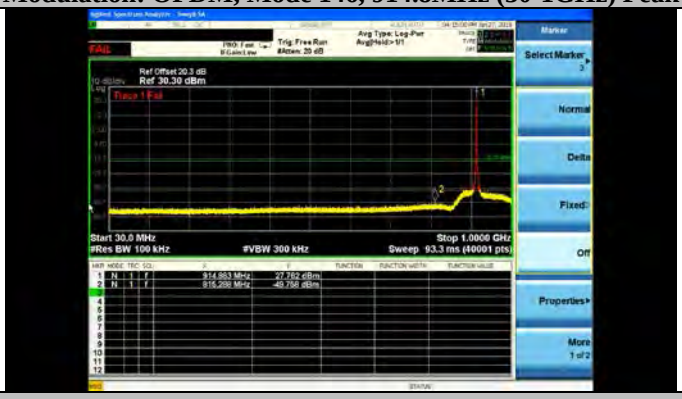
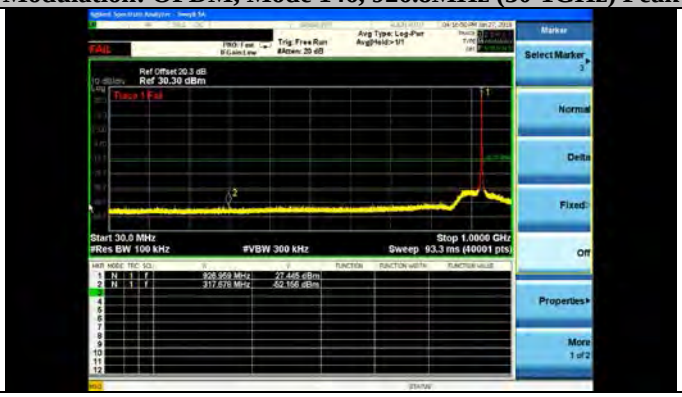
A.8.4 Emissions in Restricted Bands Graphical Test Results (2FSK and OQPSK)

Emissions in Restricted Bands	
Modulation: 2FSK, Mode 66, 902.4MHz (30-1GHz) Peak	**Mod: OQPSK, Mode 192, 902.2MHz (30-1GHz) peak**
	
Modulation: 2FSK, Mode 66, 915.2MHz (30-1GHz) Peak	**Mod: OQPSK, Mode 192, 915MHz (30-1GHz) peak**
	
Modulation: 2FSK, Mode 66, 927.6MHz (30-1GHz) Peak	**Mod: OQPSK, Mode 192, 927.8MHz (30-1GHz) peak**
	

Emissions in Restricted Bands	
Modulation: 2FSK, Mode 66, 902.4MHz (1-10GHz) Peak	**Modulation: 2FSK, Mode 66, 902.4MHz (1-10GHz) Avg**
	
Modulation: 2FSK, Mode 66, 915.2MHz (1-10GHz) Peak	**Modulation: 2FSK, Mode 66, 915.2MHz (1-10GHz) Avg**
	
Modulation: 2FSK, Mode 66, 927.6MHz (1-10GHz) Peak	**Modulation: 2FSK, Mode 66, 927.6MHz (1-10GHz) Avg**
	

Emissions in restricted bands	
Mod: OQPSK, Mode 192, 902.2MHz (1-10GHz) peak	**Mod: OQPSK, Mode 192, 902.2MHz (1-10GHz) Avg**
	
Mod: OQPSK, Mode 192, 915MHz (1-10GHz) Peak	**Mod: OQPSK, Mode 192, 915MHz (1-10GHz) Avg**
	
Mod: OQPSK, Mode 192, 927.8MHz (1-10GHz) Peak	**Mod: OQPSK, Mode 192, 927.8MHz (1-10GHz) Avg**
	

A.8.4 Emissions in Restricted Bands Graphical Test Results (OFDM Modes)

Emissions in restricted bands
Modulation: OFDM, Mode 146, 902.8MHz (30-1GHz) Peak

Modulation: OFDM, Mode 146, 914.8MHz (30-1GHz) Peak

Modulation: OFDM, Mode 146, 926.8MHz (30-1GHz) Peak


Emissions in restricted bands	
Mod: OFDM, Mode 146, 902.8MHz (1-10GHz) Peak	**Mod: OFDM, Mode 146, 902.8MHz (1-10GHz) Avg**
	
Mod: OFDM, Mode 146, 914.8MHz (1-10GHz) Peak	**Mod: OFDM, Mode 146, 914.8MHz (1-10GHz) Avg**
	
Mod: OFDM, Mode 146, 926.8MHz (1-10GHz) Peak	**Mod: OFDM, Mode 192, 926.8MHz (1-10GHz) Avg**
	

Appendix B: Radiated Test Results

B.1 Radiated Spurious Emissions & Restricted Bands

FCC 15.209; RSS-Gen 7.2.4 Issue 3

The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the table specified in the table in FCC§15.209(a) and in RSS-Gen 7.2.5.

B.1.1 Limits

Radiated emissions which fall in the restricted bands, as defined in FCC Section 15.205(a) and RSS-Gen Section 7.2.2(b), must also comply with the radiated emission limits specified in FCC Section 15.209(a) and RSS-Gen Section 7.2.5.

15.209 (a) except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (uV/meter)	Field strength (dBuV/meter)	Measurement distance (meters)
30-88	100**	40 Qp	3
88-216	150**	43.5 Qp	3
216-960	200**	46 Qp	3
Above 960	500	54 Av / 74 Pk	3

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz However, operation within These frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz Radiated emission limits in these three bands are based on measurements employing an average detector

B.1.2 Test Procedure

Ref. C63.10-2013 section 6.5 & 6.6

Test Procedure
1. Using Vasona software, configure the spectrum analyzer as shown above (be sure to enter all losses between the transmitter output and the spectrum analyzer). 2. Place the radio in continuous transmit mode. Maximize Turntable (find worst case table angle) and maximize Antenna (find worst case height). 3. Use the peak marker function to determine the maximum amplitude level. 4. Center marker frequency and perform final measurement in Quasi-peak (≤ 1Ghz) and Average (above 1 GHz) 4. Record at least 6 highest readings for the worst case operating mode.

Ref. C63.10-2013 section 4 / CISPR16-1-1

Test Parameters
Span = Entire frequency range or segment if necessary. Reference Level = 80 dBuV RBW = 100 kHz (less than or equal to 1 GHz); 1 MHz (above 1 GHz) VBW ≥ 3 x RBW Detector = Peak & Quasi-Peak (frequency range 30 MHz to 1 GHz); Peak & Average (frequency range above 1 GHz); Changing VBW to 10 Hz for average measurement Sweep Time = Couple

. The system was evaluated up to 10 GHz
. These data represent the worst case mode data for all supported operating modes and antennas.

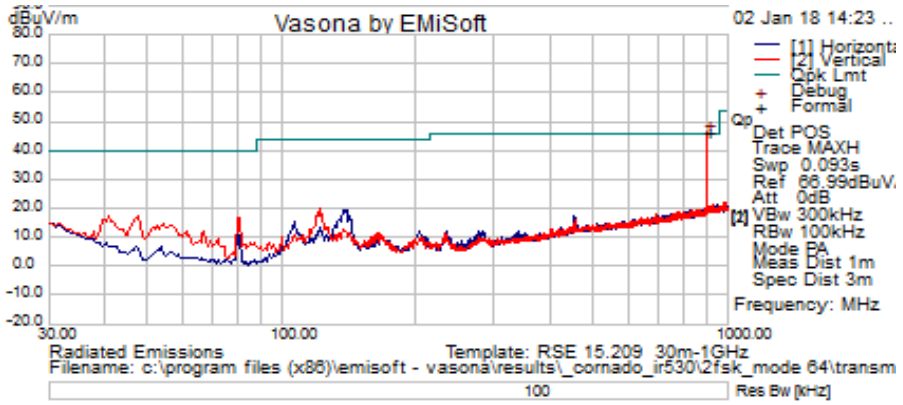
- For emissions below 1000 MHz, measurements shall be performed using a CISPR quasi-peak detector and the related measurement bandwidth. As an alternative to CISPR quasi-peak measurement, compliance with the emission limit can be demonstrated using measuring equipment employing a peak detector function properly adjusted for factors such as pulse desensitization as required, with an equal or greater measurement bandwidth relative to the applicable CISPR quasi-peak bandwidth.
- Above 1000 MHz, measurements shall be performed using an average detector with a minimum Resolution bandwidth of 1 MHz

Note2: The data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements

B.1.3 Transmitter Radiated Spurious Emissions Graphical Data Results

Subtest Date:	**02nd Jan 2018**

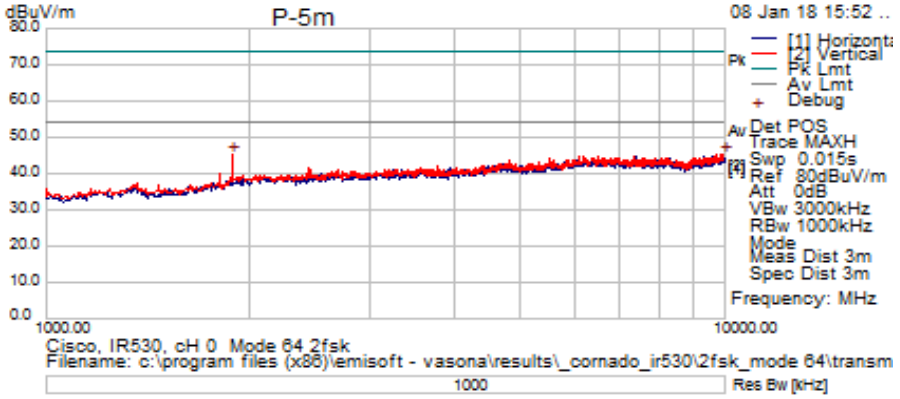
Engineer	Ronak Patel
Lab Information	Building P, 5m Anechoic
Subtest Title	Transmitter Spurious Emissions
Frequency Range	30MHz-1GHz
Comments on the above Test Results	2FSK/Mode 66, Tx Channel 0 (902.4 MHz)



Title: **TX Spurious Emissions from 30MHz-1GHz – Ch0 (902.4 MHz)**

Frequency (MHz)	**Raw (dBuV)**	**Cab Loss (dB)**	**AF (dB)**	**Level (dBuV)**	**Detector**	**Polarity**	**Height (cm)**	**Azt (Deg)**	**Limit (dBuV)**	**Margin (dB)**	**Results Pass / Fail**	**Comments**
902.3938	30.44	2.79	13.11	46.33	Peak	V	150	0	46	0.33	Pass	Channel 0

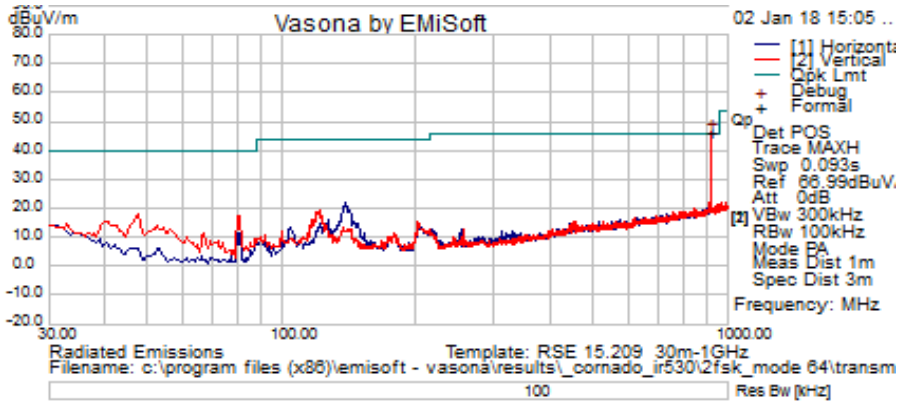
Subtest Date:	**8th Jan 2018**
Engineer	Ronak Patel
Lab Information	Building P, 5m Anechoic
Subtest Title	Transmitter Spurious Emissions
Frequency Range	1-10GHz
Comments on the above Test Results	2FSK/Mode 66, Tx Channel 0 (902.4 MHz)



Title: **TX Spurious Emissions from 1-10GHz – Ch0 (902.2 MHz)**

Frequency (MHz)	Raw (dBuV)	Cab Loss (dB)	AF (dB)	Level (dBuV)	Detector	Polarity	Height (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)	Results Pass / Fail	Comments
9983.125	37.54	10.69	-2.89	45.33	Peak	V	100	0	54	-8.67	Pass	
1883.125	53.56	4.12	-12.49	45.19	Peak	V	100	0	54	-8.81	Pass	2nd Harmonics

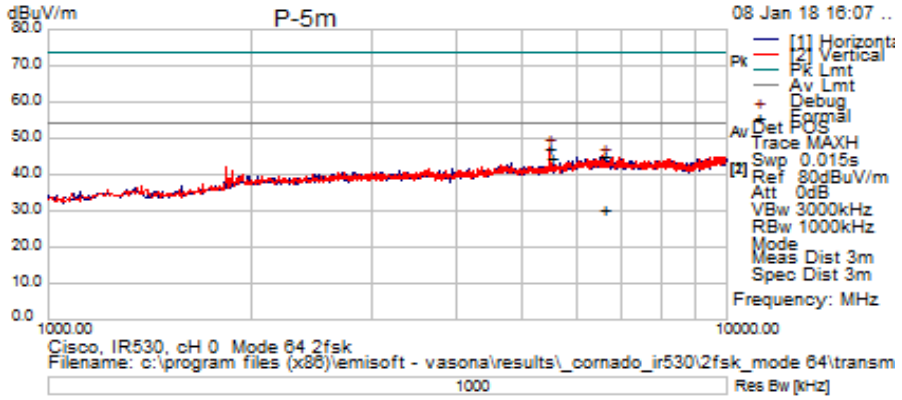
Subtest Date:	**02nd Jan 2018**
Engineer	Ronak Patel
Lab Information	Building P, 5m Anechoic
Subtest Title	Transmitter Spurious Emissions
Frequency Range	30MHz-1GHz
Comments on the above Test Results	2FSK/Mode 66, Tx Channel 32 (915.2 MHz)



Title: **TX Spurious Emissions from 30MHz-1GHz – Ch32 (915.2 MHz)**

Frequency (MHz)	Raw (dBuV)	Cab Loss (dB)	AF (dB)	Level (dBuV)	Detector	Polarity	Height (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)	Results Pass / Fail	Comments
915.125	30.32	2.82	13.26	46.4	Peak	V	100	0	46	0.4	Pass	Channel 32

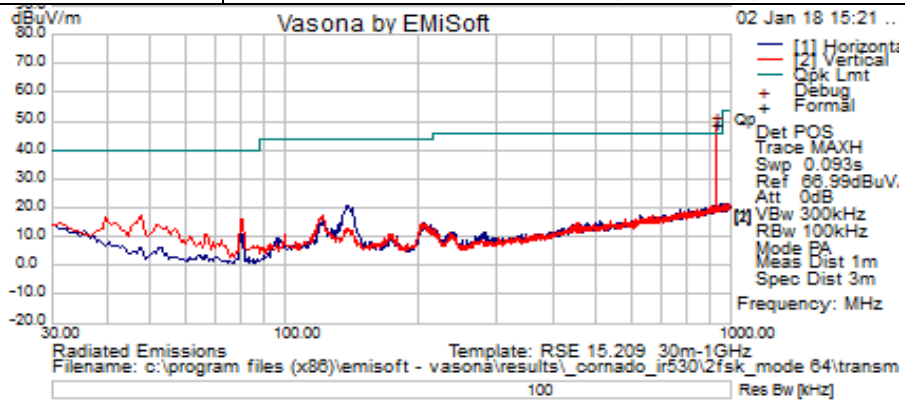
Subtest Date:	**8th Jan 2018**
Engineer	Ronak Patel
Lab Information	Building P, 5m Anechoic
Subtest Title	Transmitter Spurious Emissions
Frequency Range	1-10GHz
Comments on the above Test Results	2FSK/Mode 66, Tx Channel 32 (915.2 MHz)



Title: **TX Spurious Emissions from 1-10GHz – Ch32 (915.2 MHz)**

Frequency (MHz)	Raw (dBuV)	Cab Loss (dB)	AF (dB)	Level (dBuV)	Detector	Polarity	Height (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)	Results Pass / Fail	Comments
5488.75	47.06	7.37	-7.03	47.4	Peak	V	200	164	54	-6.6	Pass	6th Harmonics
5490.1925	44.34	7.37	-7.03	44.67	Average	V	200	164	54	-9.33	Pass	
6572.7	26.96	8.28	-4.92	30.31	Average	V	400	25	54	-23.69	Pass	
6580	41.54	8.28	-4.79	45.03	Peak	V	400	25	54	-8.97	Pass	

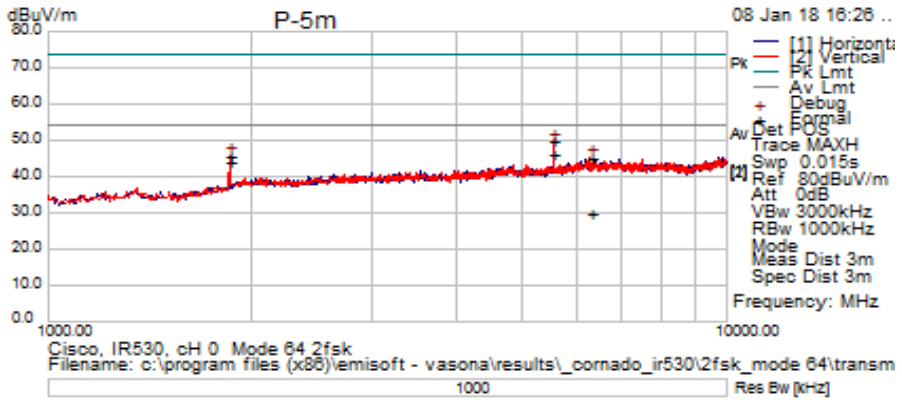
Subtest Date:	**02nd Jan 2018**
Engineer	Ronak Patel
Lab Information	Building P, 5m Anechoic
Subtest Title	Transmitter Spurious Emissions
Frequency Range	30MHz-1GHz
Comments on the above Test Results	2FSK/Mode 66, Tx Channel 63 (927.6 MHz)



Title: **TX Spurious Emissions from 30MHz-1GHz – Ch63 (927.6 MHz)**

Frequency (MHz)	Raw (dBuV)	Cab Loss (dB)	AF (dB)	Level (dBuV)	Detector	Polarity	Height (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)	Results Pass / Fail	Comments
927.6632	32.99	2.84	13.06	48.89	Peak	V	100	0	46	2.89	Pass	Channel 63

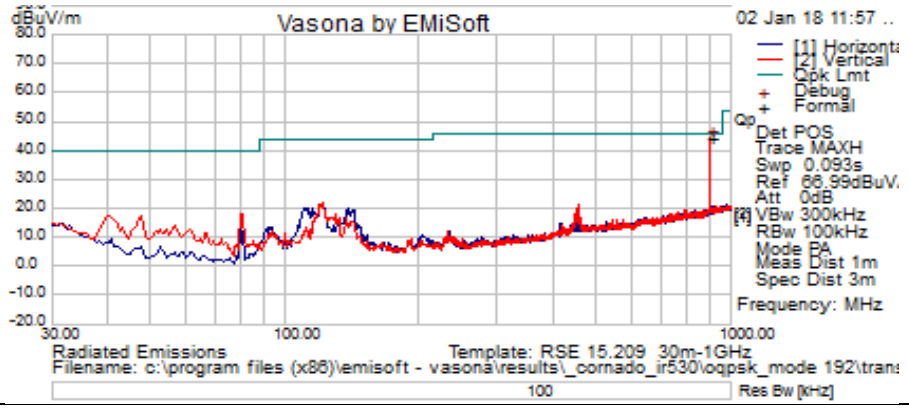
Subtest Date:	**8th Jan 2018**
Engineer	Ronak Patel
Lab Information	Building P, 5m Anechoic
Subtest Title	Transmitter Spurious Emissions
Frequency Range	1-10GHz
Comments on the above Test Results	2FSK/Mode 66, Tx Channel 63 (927.6 MHz)



Title: **TX Spurious Emissions from 1-10GHz – Ch63 (927.6 MHz)**

Frequency (MHz)	Raw (dBuV)	Cab Loss (dB)	AF (dB)	Level (dBuV)	Detector	Polarity	Height (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)	Results Pass / Fail	Comments
1855	54.54	4.08	-12.9	45.73	Peak	V	100	60	54	-8.27	Pass	2nd Harm
1855.7253	52.98	4.08	-12.89	44.18	Average	V	100	60	54	-9.82	Pass	2nd Harm
5567.5	49.06	7.4	-6.62	49.85	Peak	V	200	235	54	-4.16	Pass	6th Harm
5567.0105	45.66	7.4	-6.62	46.44	Average	V	200	235	54	-7.56	Pass	6th Harm
6298.75	42.27	8.09	-5.09	45.27	Peak	V	300	117	54	-8.73	Pass	
6298.335	26.72	8.09	-5.09	29.71	Average	V	300	117	54	-24.29	Pass	

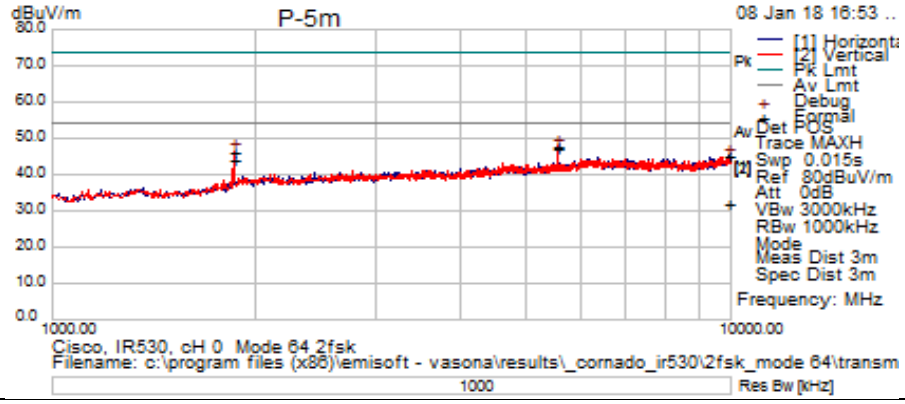
Subtest Date:	**02nd Jan 2018**
Engineer	Ronak Patel
Lab Information	Building P, 5m Anechoic
Subtest Title	Transmitter Spurious Emissions
Frequency Range	30MHz-1GHz
Comments on the above Test Results	OQPSK/Mode 192, Tx Channel 0 (902.2 MHz)



Title: **TX Spurious Emissions from 30MHz-1GHz – Ch0 (902.2 MHz)**

Frequency (MHz)	Raw (dBuV)	Cab Loss (dB)	AF (dB)	Level (dBuV)	Detector	Polarity	Height (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)	Results Pass / Fail	Comments
902.39375	28.45	2.79	13.11	44.34	Peak	V	150	0	46	-1.66	Pass	Channel 0

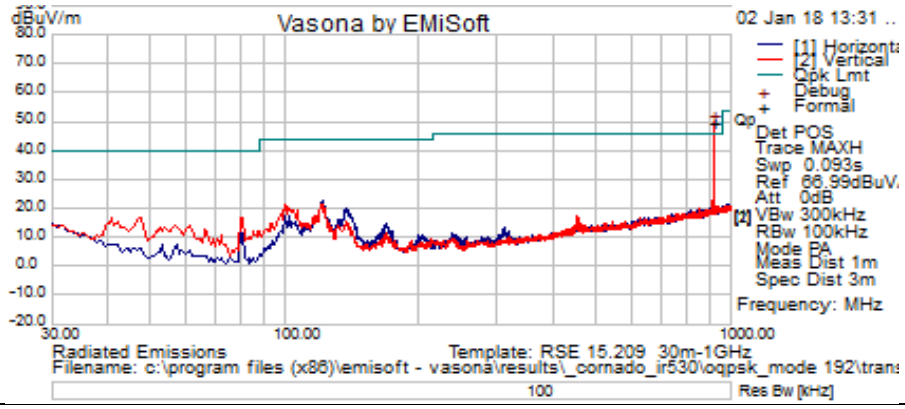
Subtest Date:	**8th Jan 2018**
Engineer	Ronak Patel
Lab Information	Building P, 5m Anechoic
Subtest Title	Transmitter Spurious Emissions
Frequency Range	1-10GHz
Comments on the above Test Results	OQPSK/Mode 192, Tx Channel 0 (902.2 MHz)



Title: **TX Spurious Emissions from 1-10GHz – Ch0 (902.2 MHz)**

Frequency (MHz)	Raw (dBuV)	Cab Loss (dB)	AF (dB)	Level (dBuV)	Detector	Polarity	Height (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)	Results Pass / Fail	Comments
1855	55.18	4.08	-12.9	46.36	Peak	V	100	62	54	-7.64	Pass	2nd Harm
1855.5325	53.15	4.08	-12.89	44.34	Average	V	100	62	54	-9.66	Pass	
5567.5	47	7.4	-6.62	47.78	Peak	V	200	234	54	-6.22	Pass	6th Harmon
5566.7584	46.71	7.4	-6.62	47.49	Average	V	200	234	54	-6.51	Pass	
9921.25	37.32	10.66	-2.83	45.15	Peak	H	300	290	54	-8.85	Pass	
9890.36	24.21	10.61	-2.97	31.86	Average	H	300	290	54	-22.14	Pass	

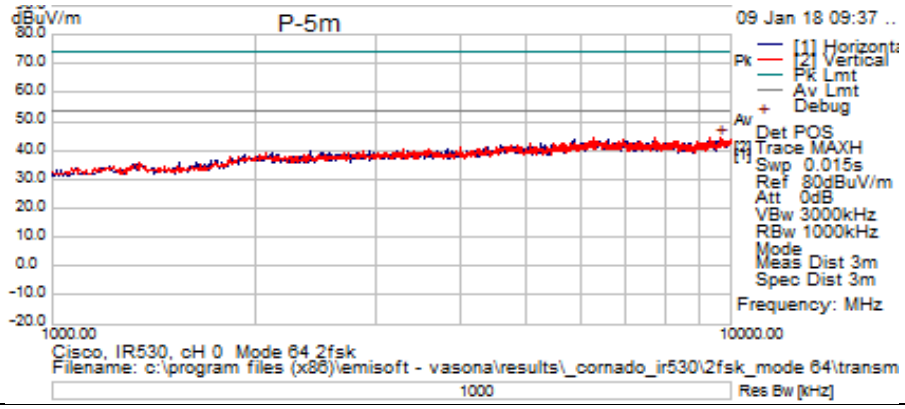
Subtest Date:	**02nd Jan 2018**
Engineer	Ronak Patel
Lab Information	Building P, 5m Anechoic
Subtest Title	Transmitter Spurious Emissions
Frequency Range	30MHz-1GHz
Comments on the above Test Results	OQPSK/Mode 192, Tx Channel 64 (915 MHz)



Title: **TX Spurious Emissions from 30MHz-1GHz – Ch64 (915 MHz)**

Frequency (MHz)	Raw (dBuV)	Cab Loss (dB)	AF (dB)	Level (dBuV)	Detector	Polarity	Height (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)	Results Pass / Fail	Comments
915.125	33.45	2.82	13.26	49.53	Peak	V	100	0	46	3.53	Pass	Channel 64

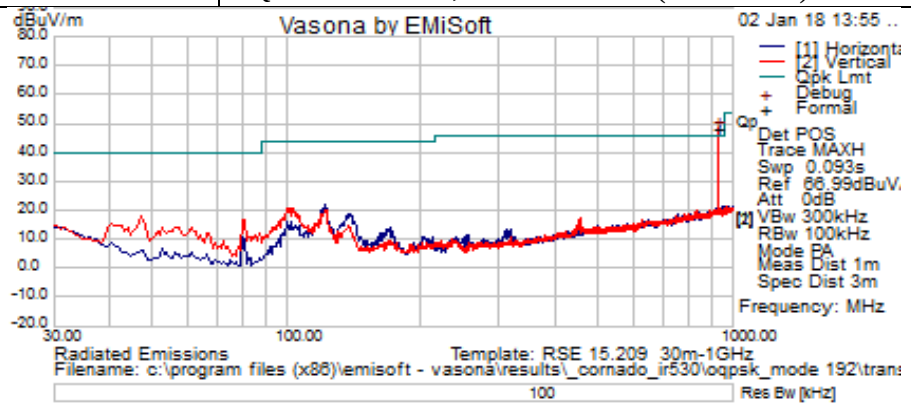
Subtest Date:	**9th Jan 2018**
Engineer	Ronak Patel
Lab Information	Building P, 5m Anechoic
Subtest Title	Transmitter Spurious Emissions
Frequency Range	1-10GHz
Comments on the above Test Results	OQPSK/Mode 192, Tx Channel 64 (915 MHz)



Title: **TX Spurious Emissions from 1-10GHz – Ch64 (915 MHz)**

Frequency (MHz)	Raw (dBuV)	Cab Loss (dB)	AF (dB)	Level (dBuV)	Detector	Polarity	Height (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)	Results Pass / Fail	Comments
9645.625	37.46	10.4	-3.14	44.72	Peak	V	100	251	54	-9.29	Pass	

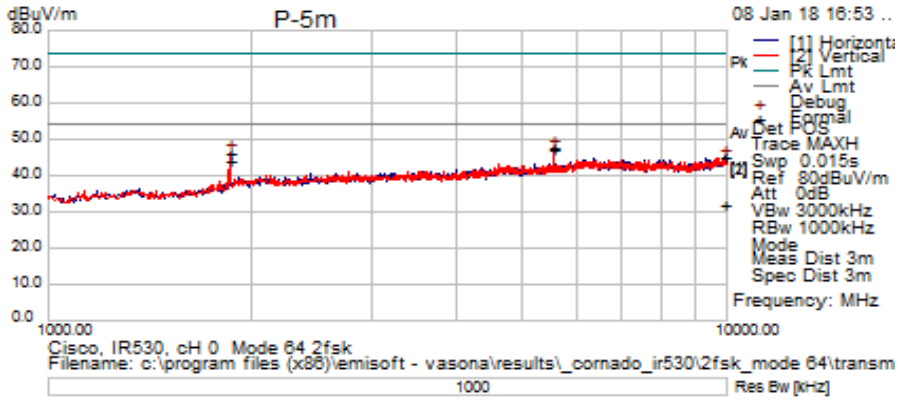
Subtest Date:	**02nd Jan 2018**
Engineer	Ronak Patel
Lab Information	Building P, 5m Anechoic
Subtest Title	Transmitter Spurious Emissions
Frequency Range	30MHz-1GHz
Comments on the above Test Results	OQPSK/Mode 192, Tx Channel 128(927.8 MHz)



Title: **TX Spurious Emissions from 30MHz-1GHz – Ch128 (927.8 MHz)**

Frequency (MHz)	Raw (dBuV)	Cab Loss (dB)	AF (dB)	Level (dBuV)	Detector	Polarity	Height (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)	Results Pass / Fail	Comments
927.85625	32.25	2.84	13.06	48.15	Peak	V	150	0	46	2.15	Pass	Channel 128

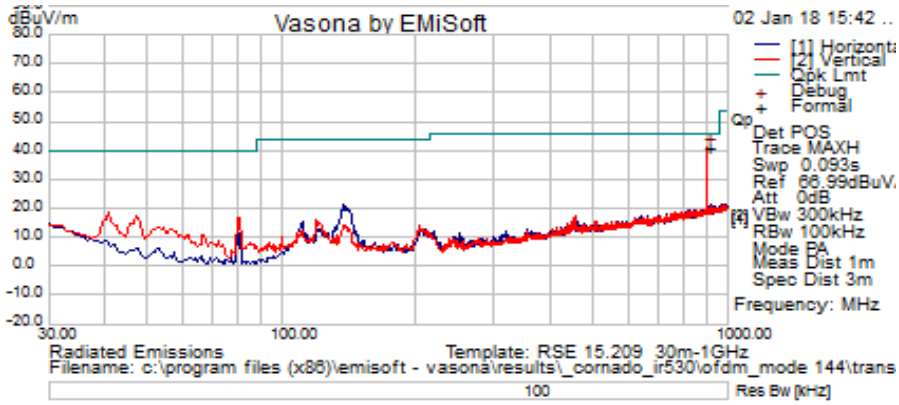
Subtest Date:	**8th Jan 2018**
Engineer	Ronak Patel
Lab Information	Building P, 5m Anechoic
Subtest Title	Transmitter Spurious Emissions
Frequency Range	1-10GHz
Comments on the above Test Results	OQPSK/Mode 192, Tx Channel 128 (927.8 MHz)



Title: **TX Spurious Emissions from 1-10GHz – Ch128 (927.8 MHz)**

Frequency (MHz)	Raw (dBuV)	Cab Loss (dB)	AF (dB)	Level (dBuV)	Detector	Polarity	Height (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)	Results Pass / Fail	Comments
1855	55.18	4.08	-12.9	46.36	Peak	V	100	62	54	-7.64	Pass	2nd Harmonics
1855.5325	53.15	4.08	-12.89	44.34	Average	V	100	62	54	-9.66	Pass	
5567.5	47	7.4	-6.62	47.78	Peak	V	200	234	54	-6.22	Pass	6th Harmonics
5566.7584	46.71	7.4	-6.62	47.49	Average	V	200	234	54	-6.51	Pass	
9921.25	37.32	10.66	-2.83	45.15	Peak	H	300	290	54	-8.85	Pass	
9890.36	24.21	10.61	-2.97	31.86	Average	H	300	290	54	-22.14	Pass	

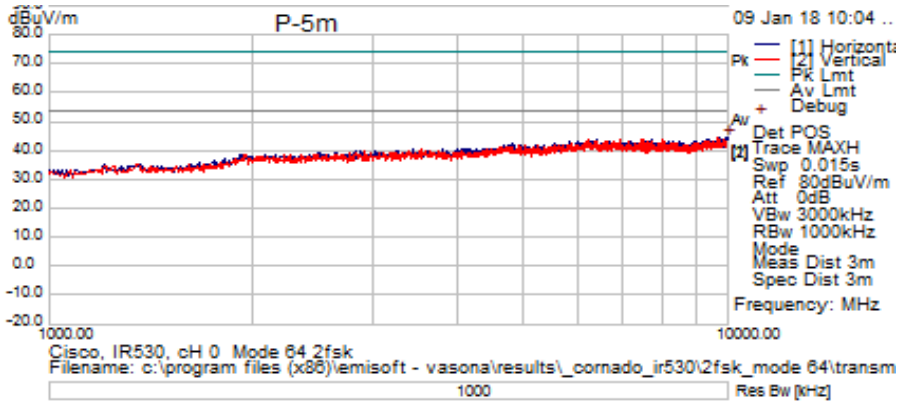
Subtest Date:	**02nd Jan 2018**
Engineer	Ronak Patel
Lab Information	Building P, 5m Anechoic
Subtest Title	Transmitter Spurious Emissions
Frequency Range	30MHz-1GHz
Comments on the above Test Results	OFDM/Mode 146, Tx Channel 0(902.8 MHz)



Title: **TX Spurious Emissions from 30MHz-1GHz – Ch0(902.8 MHz)**

Frequency (MHz)	Raw (dBuV)	Cab Loss (dB)	AF (dB)	Level (dBuV)	Detector	Polarity	Height (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)	Results Pass / Fail	Comments
902.3938	25.22	2.79	13.11	41.11	Peak	H	150	0	46	-4.89	Pass	Channel 0

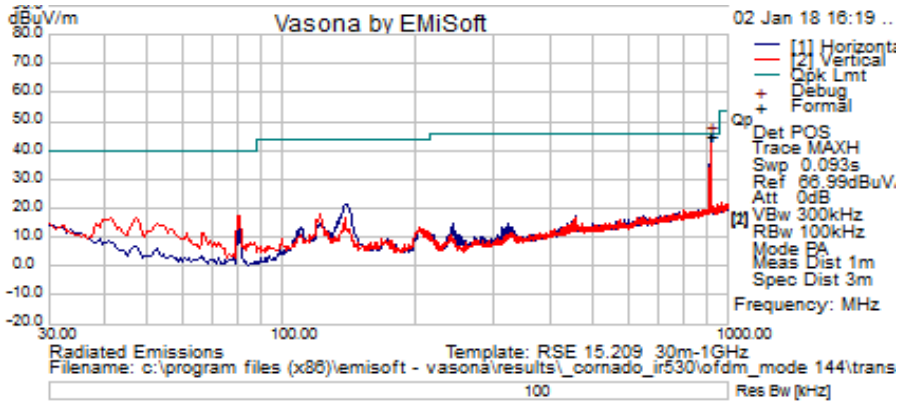
Subtest Date:	**9th Jan 2018**
Engineer	Ronak Patel
Lab Information	Building P, 5m Anechoic
Subtest Title	Transmitter Spurious Emissions
Frequency Range	1-10GHz
Comments on the above Test Results	OFDM/Mode 146, Tx Channel 0 (902.8 MHz)



Title: **TX Spurious Emissions from 1-10GHz – Ch0 (902.8 MHz)**

Frequency (MHz)	Raw (dBuV)	Cab Loss (dB)	AF (dB)	Level (dBuV)	Detector	Polarity	Height (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)	Results Pass / Fail	Comments
9971.875	36.89	10.7	-2.87	44.72	Peak	H	150	232	54	-9.28	Pass	

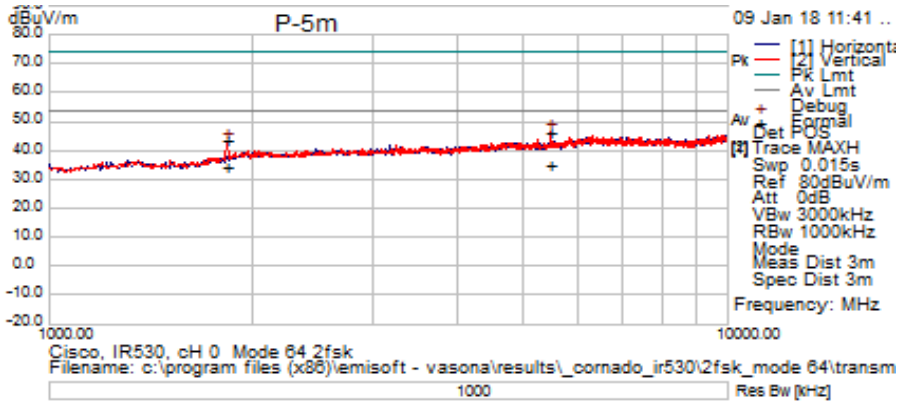
Subtest Date:	**02nd Jan 2018**
Engineer	Ronak Patel
Lab Information	Building P, 5m Anechoic
Subtest Title	Transmitter Spurious Emissions
Frequency Range	30MHz-1GHz
Comments on the above Test Results	OFDM/Mode 146, Tx Channel 15(902.8 MHz)



Title: **TX Spurious Emissions from 30MHz-1GHz – Ch15(914.8 MHz)**

Frequency (MHz)	Raw (dBuV)	Cab Loss (dB)	AF (dB)	Level (dBuV)	Detector	Polarity	Height (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)	Results Pass / Fail	Comments
915.125	29.29	2.82	13.26	45.37	Peak	H	150	0	46	-0.63	Pass	Channel 15

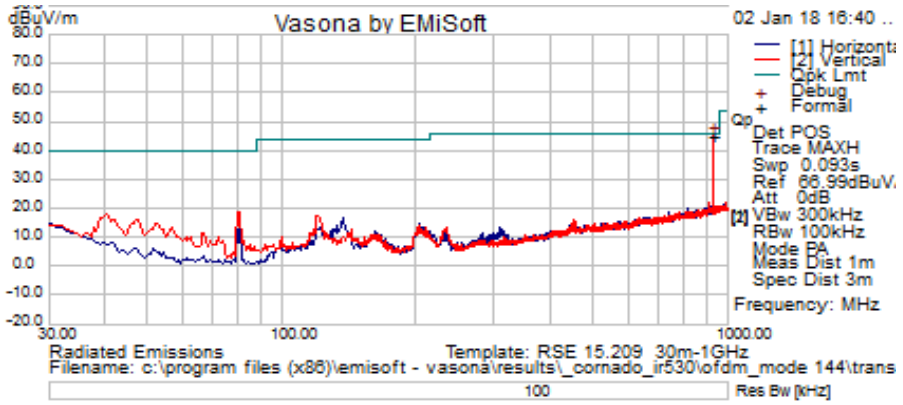
Subtest Date:	**9th Jan 2018**
Engineer	Ronak Patel
Lab Information	Building P, 5m Anechoic
Subtest Title	Transmitter Spurious Emissions
Frequency Range	1-10GHz
Comments on the above Test Results	OFDM/Mode 146, Tx Channel 15(914.8 MHz)



Title: **TX Spurious Emissions from 1-10GHz – Ch15 (914.8 MHz)**

Frequency (MHz)	Raw (dBuV)	Cab Loss (dB)	AF (dB)	Level (dBuV)	Detector	Polarity	Height (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)	Results Pass / Fail	Comments
1826.875	52.56	4.05	-13.19	43.42	Peak	V	150	51	54	-10.58	Pass	2nd Harmonics
1829.3441	43.46	4.05	-13.17	34.34	Average	V	150	50	54	-19.66	Pass	2nd Harmonics
5488.75	46.22	7.37	-7.03	46.56	Peak	V	200	178	54	-7.44	Pass	6th Harmonics
5488.3475	35.08	7.37	-7.03	35.42	Average	V	200	177	54	-18.59	Pass	6th Harmonics

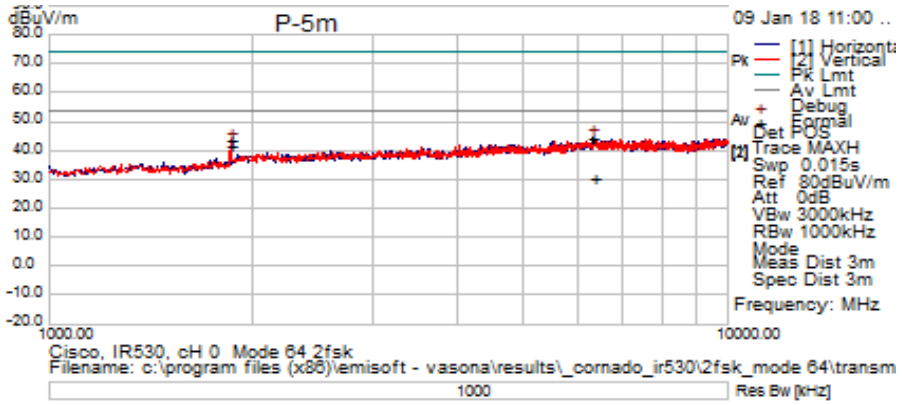
Subtest Date:	**02nd Jan 2018**
Engineer	Ronak Patel
Lab Information	Building P, 5m Anechoic
Subtest Title	Transmitter Spurious Emissions
Frequency Range	30MHz-1GHz
Comments on the above Test Results	OFDM/Mode 146, Tx Channel 30(926.8 MHz)



Title: **TX Spurious Emissions from 30MHz-1GHz – Ch30(926.8 MHz)**

Frequency (MHz)	Raw (dBuV)	Cab Loss (dB)	AF (dB)	Level (dBuV)	Detector	Polarity	Height (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)	Results Pass / Fail	Comments
927.25	29.4	2.84	13.06	45.3	Peak	V	100	0	46	-0.7	Pass	Channel 30

Subtest Date:	**9th Jan 2018**
Engineer	Ronak Patel
Lab Information	Building P, 5m Anechoic
Subtest Title	Transmitter Spurious Emissions
Frequency Range	1-10GHz
Comments on the above Test Results	OFDM/Mode 146, Tx Channel 30(926.8 MHz)



Title: **TX Spurious Emissions from 1-10GHz – Ch30(926.8 MHz)**

Frequency (MHz)	Raw (dBuV)	Cab Loss (dB)	AF (dB)	Level (dBuV)	Detector	Polarity	Height (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)	Results Pass / Fail	Comments
1855	52.49	4.08	-12.9	43.67	Peak	V	150	51	54	-10.33	Pass	2nd Harmonics
1853.7513	50.85	4.08	-12.91	42.02	Average	V	150	54	54	-11.98	Pass	2nd Harmonics
6326.875	41.47	8.11	-4.97	44.61	Peak	H	200	305	54	-9.39	Pass	7th Harmonics
6364.845	27	8.12	-4.84	30.29	Average	H	200	305	54	-23.71	Pass	7th Harmonics

Appendix C: AC Power Line Conducted Emissions

FCC 15.207

Except when the requirements applicable to a given device state otherwise, for any radio apparatus equipped to operate from the public utility AC power supply, either directly or indirectly (such as with a battery charger), the radio frequency voltage of emissions conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in the table in these sections. The more stringent limit applies at the frequency range boundaries.

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A radio apparatus that is designed to be connected to the public utility (AC) power line shall ensure that the radio frequency voltage, which is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz-30 MHz, shall not exceed the limits .

Unless the requirements applicable to a given device state otherwise, for any radio apparatus equipped to operate from the public utility AC power supply either directly or indirectly (such as with a battery charger), the radio frequency voltage of emissions conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown below. The more stringent limit applies at the frequency range boundaries.

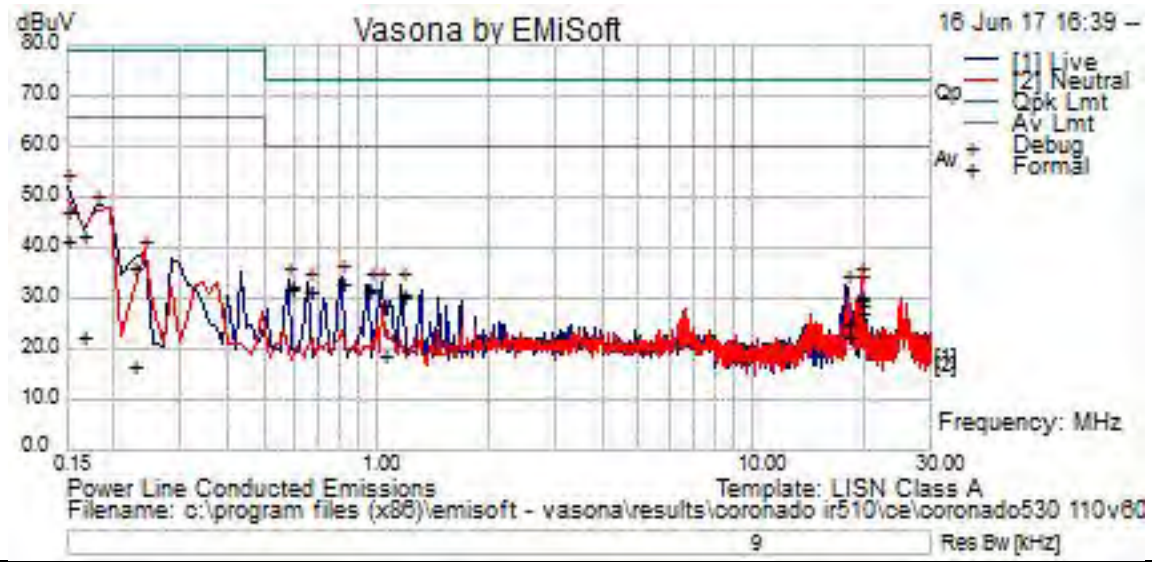
Test Number: 201740 **Spec ID:** 2680				
Basic Standard	**Applied to**	**Class**	**Freq Range**	**Test Details / Comments**
CFR47 Part 15 Subpart B	AC Power Line	A	0.15MHz - 30MHz	U.S line voltages must be used. 110V 60Hz and/or 208V 60Hz (only when the product has a dedicated 208V input). FCC test method ANSI C63-4 2014.
Operating Mode	**Mode :** 1, IR530 - WW Formal Test			
Power Input	110, 60Hz (+/-20%)			
Overall Result	Pass			
Comments	No further comments			
Deviation	There were no deviations from the specification			

System Number	Description	Samples	System under test	Support equipment
1	EUT-IR530	S02	☑	☐
2	Support Equipment (IR510, CGM, ASR1k switch, Isolator switch, Rackmount computer with Monitor, Laptop, Keyboard and Mouse)	S01, S03, S04, S06, S07, S08, S09, S10, S11, S12, S13 and S14	☐	☑
3	Ixia Traffic Generator	S05	☐	☑

Subtest Number: 201740 - 1	**Subtest Date:** 31-Jul-2017
Engineer	Chakravarthy Sulva
Lab Information	Building P, Shield Room 1
Subtest Results	
Line Under Test	[A] AC Power
Transducer	LISN
Subtest Result	Pass
Highest Frequency	30.0
Lowest Frequency	0.15
Comments on the above Test Results	EUT powered by 110V/60Hz.
Environmental Conditions:	
Temperature: (59 to 95)F	69.3F
Humidity: (10 to 75)%:	50.7%
Comments:	

Equipment used:					
Equipment No	Manufacturer	Model	Description	Last Cal	Next Cal Due Date
CIS002464	Fischer Custom Communications	FCC-801-M2-16	CDN, 2-LINE, 16A	10-MAR-17	10-MAR-18
CIS005687	Fluke	73 III	Digital Multimeter	03-NOV-16	03-NOV-17
CIS007704	Fischer Custom Communications	FCC-LISN-50/250-50-2-01	LISN	05-MAY-17	05-MAY-18
CIS007705	Fischer Custom Communications	FCC-LISN-50/250-50-2-01	LISN	02-JUN-17	02-JUN-18
CIS018963	York	CNE V	Comparison Noise Emitter, 30 - 1000MHz	Cal Not Required	N/A
CIS020913	Fischer Custom Communications	FCC-LISN-PA-NEMA-5-15	AC Adapter	05-MAY-17	05-MAY-18
CIS021135	Fischer Custom Communications	FCC-LISN-PA-NEMA-5-15	AC Adapter	02-JUN-17	02-JUN-18
CIS029960	Fischer Custom Communications	FCC-LISN-50/250-50-2-01	LISN	09-MAR-17	09-MAR-18
CIS029962	Fischer Custom Communications	FCC-LISN-PA-NEMA-5-15	Power Adaptor, Polarized 120VAC	09-MAR-17	09-MAR-18
CIS035236	Stanley	33-696	5 Meter Tape Measure	Cal Not Required	N/A
CIS045050	Rohde & Schwarz	ESCI	EMI Test Receiver	09-NOV-16	09-NOV-17
CIS046719	Bird	5-T-MB	5W 50 Ohm BNC Termination 4GHz	28-NOV-16	28-NOV-17
CIS047408	Teseq	CCN 1000-1	Harmonic/Flicker Test System -AC Power Analyzer	04-JAN-17	04-JAN-18
CIS047409	Teseq	NSG 1007	Harmonic/Flicker Test System -AC Power Source	04-JAN-17	04-JAN-18
CIS049468	Coleman	RG223	BNC 25 ft Cable	10-MAR-17	10-MAR-18
CIS049481	Coleman	RG223	BNC 2ft Cable	12-APR-17	12-APR-18
CIS049532	TTE	H785-150K-50-21378	High Pass Filter	03-MAY-17	03-MAY-18
CIS049555	Bird	5-T-MB	5W 50 Ohm BNC Termination 4GHz	10-AUG-16	10-AUG-17
CIS049560	Bird	5-T-MB	5W 50 Ohm BNC Termination 4GHz	10-AUG-16	10-AUG-17
CIS051750	Bird	5-T-MB	5W 50 Ohm BNC Termination 4GHz	10-AUG-16	10-AUG-17
CIS054231	Newport	iBTHP-5-DB9	5 inch Temp/RH/Press Sensor w/20ft cable	09-FEB-17	09-FEB-18

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements



Title: CE 150K-30MHz, 110V/60Hz

Frequency MHz	Raw dBuV	Cable Loss	Factors dB	Level dBuV	Measurement Type	Line	Limit dBuV	Margin dB	Pass /Fail	Comments
0.150219	20.1	21.2	0.1	41.3	Av	L	66	-24.7	Pass	
0.807888	13.2	19.9	0	33.2	Av	L	60	-26.8	Pass	
0.588189	12.3	19.9	0	32.2	Av	L	60	-27.8	Pass	
0.954222	11.8	19.9	0	31.7	Av	L	60	-28.3	Pass	
0.661464	11.5	19.9	0	31.4	Av	L	60	-28.6	Pass	
1.175	10.5	19.9	0	30.4	Av	L	60	-29.6	Pass	
19.475	8	20.4	0.1	28.6	Av	N	60	-31.4	Pass	
0.150219	25.9	21.2	0.1	47.1	Qp	L	79	-31.9	Pass	
19.591	6.5	20.4	0.1	27.1	Av	N	60	-32.9	Pass	
0.165432	21.5	21	0.1	42.6	Qp	L	79	-36.4	Pass	
17.842	2	20.4	0.1	22.5	Av	L	60	-37.5	Pass	
0.807888	13.3	19.9	0	33.2	Qp	L	73	-39.8	Pass	
0.588189	12.4	19.9	0	32.3	Qp	L	73	-40.7	Pass	
1.041	-1	19.9	0	18.9	Av	L	60	-41.1	Pass	
0.954222	11.9	19.9	0	31.8	Qp	L	73	-41.2	Pass	
0.661464	11.6	19.9	0	31.5	Qp	L	73	-41.5	Pass	
1.175	10.8	19.9	0	30.8	Qp	L	73	-42.2	Pass	
19.475	9.8	20.4	0.1	30.4	Qp	N	73	-42.6	Pass	
0.223602	15.2	20.7	0	36	Qp	N	79	-43	Pass	
19.591	9.3	20.4	0.1	29.9	Qp	N	73	-43.1	Pass	
0.165432	1.1	21	0.1	22.2	Av	L	66	-43.8	Pass	
1.041	8.9	19.9	0	28.8	Qp	L	73	-44.2	Pass	
17.842	4.6	20.4	0.1	25.1	Qp	L	73	-47.9	Pass	
0.223602	-4	20.7	0	16.7	Av	N	66	-49.3	Pass	

Appendix D: List of Test Equipment Used to perform the test

Radiated Testing

Equip#	Manufacturer/ Model	Description	Last Cal	Next Due
42013	ETS Lindgren/3117	Double Ridged Horn Antenna	04th May 2017	04th May 2018
45096	CISCO/TH0118	Mast Mount Preamplifier Array, 1-18GHz	31st Oct 2017	31st Oct 2018
47300	Keysight (Agilent/HP)/ N9038A	EMI Receiver	28th Mar 2017	28th Mar 2018
49563	HUBER + SUHNER/ Sucoflex 106A	Coaxial Cable, 8m	21st Aug 2017	21st Aug 2018
21117	MICRO-COAX/UFB311A-0-2484-520520	Coaxial Cable-18Ghz	16th Aug 2017	16th Aug 2018
25662	MICRO-COAX/UFB311A-1-0840-504504	Coaxial Cable, 84.0 in. to 18GHz	21st Aug 2017	21st Aug 2018
56128	PASTERNACK/PE6072	SMA 50 Ohm Termination	1st Dec 2017	1st Dec 2018
35235	LUFKIN/HY1035CME	Tape Measure	n/a	n/a
30654	SUNOL SCIENCES/JB1	Combination Antenna, 30MHz-2GHz	19th Jan 2018	19th Jan 2019
40597	CISCO/Above 1GHz Site Cal	1GHz Cispr Site Verification	26th Sep 2017	26th Sep 2018
8448	CISCO/NSA CAL	NSA Chamber	06th Oct 2017	06th Oct 2018
8171	Keysight (Agilent/HP)/ 8491B Opt 010	ATTENUATOR	26th April 2017	26th April 2018
Conducted testing				
49516	Keysight (Agilent/HP)/ N9030A-550	PXA Signal Analyzer, 3Hz to 50GHz	02nd Nov 2017	02nd Nov 2018
54402	HUBER + SUHNER/Sucoflex 102	RF Cable 2.4mm - N Type 18GHz	20th Apr 2017	20th Apr 2018
55603	MINI-CIRCUITS/BW-S10-2W263	SMA 10dB Attenuator	31st Aug 2017	31st Aug 2018
54367	AEROFLEX/ 40AH2W-20	SMA Attenuator, 20 dB 40GHz	21st Apr 2017	21st Apr 2018
46385	Micro-Tronics/HPM16310	Highpass Filter	26th Jun 2017	26th Jun 2018

Appendix E: Abbreviation Key and Definitions

The following table defines abbreviations used within this test report.

Abbreviation	Description	Abbreviation	Description
EMC	Electro Magnetic Compatibility	°F	Degrees Fahrenheit
EMI	Electro Magnetic Interference	°C	Degrees Celsius
EUT	Equipment Under Test	Temp	Temperature
ITE	Information Technology Equipment	S/N	Serial Number
TAP	Test Assessment Schedule	Qty	Quantity
ESD	Electro Static Discharge	Emf	Electromotive force
EFT	Electric Fast Transient	RMS	Root mean square
EDCS	Engineering Document Control System	Qp	Quasi Peak
Config	Configuration	Av	Average
CIS#	Cisco Number (unique identification number for Cisco test equipment)	Pk	Peak
Cal	Calibration	kHz	Kilohertz ($1x10^3$)
EN	European Norm	MHz	MegaHertz ($1x10^6$)
IEC	International Electro technical Commission	GHz	Gigahertz ($1x10^9$)
CISPR	International Special Committee on Radio Interference	H	Horizontal
CDN	Coupling/Decoupling Network	V	Vertical
LISN	Line Impedance Stabilization Network	dB	decibel
PE	Protective Earth	V	Volt
GND	Ground	kV	Kilovolt ($1x10^3$)
L1	Line 1	µV	Microvolt ($1x10^{-6}$)
L2	Line2	A	Amp
L3	Line 3	µA	Micro Amp ($1x10^{-6}$)
DC	Direct Current	mS	Milli Second ($1x10^{-3}$)
RAW	Uncorrected measurement value, as indicated by the measuring device	µS	Micro Second ($1x10^{-6}$)
RF	Radio Frequency	µS	Micro Second ($1x10^{-6}$)
SLCE	Signal Line Conducted Emissions	M	Meter
Meas dist	Measurement distance	Spec dist	Specification distance
N/A or NA	Not Applicable	SL	Signal Line (or Telecom Line)
P	Power Line	L	Live Line
N	Neutral Line	R	Return
S	Supply	AC	Alternating Current

Appendix F: Software Used to Perform Testing

EMIsoft Vasona, version 6.024

Appendix G: Test Procedures

Measurements were made in accordance with

- ANSI C63.10:2013,
- 558074 D01 DTS Meas Guidance v04
- RSS Gen Issue 4
- Public Notice DA Public notice DA-00 705

Appendix H: Scope of Accreditation (A2LA certificate number 1178-01)

The scope of accreditation of Cisco Systems, Inc. can be found on the A2LA web page at:

http://www.a2la.org/scopepdf/1178-01.pdf

Appendix I: Worst Case Justification

Worst case modes were selected by ANSI C63.10 2013 Section **5.6.2.2**

For devices with multiple operating modes, measurements on the middle channel can be used to determine the worst-case mode(s). The worst-case modes are as follows:

a) Band edge requirements—Measurements on the mode with the widest bandwidth can be used to cover the same channel (center frequency) on modes with narrower bandwidth that have the same or lower output power for each modulation family (e.g., OFDM and direct sequence spread spectrum).

b) Spurious emissions—Measure the mode with the highest output power and the mode with the highest output power spectral density for each modulation family (e.g., OFDM and direct sequence spread spectrum).

c) In-band PSD—Measurements on the mode with the narrowest bandwidth can be used to cover all modes within the same modulation family of an equal or lower output power provided the result is less than 50% of the limit.