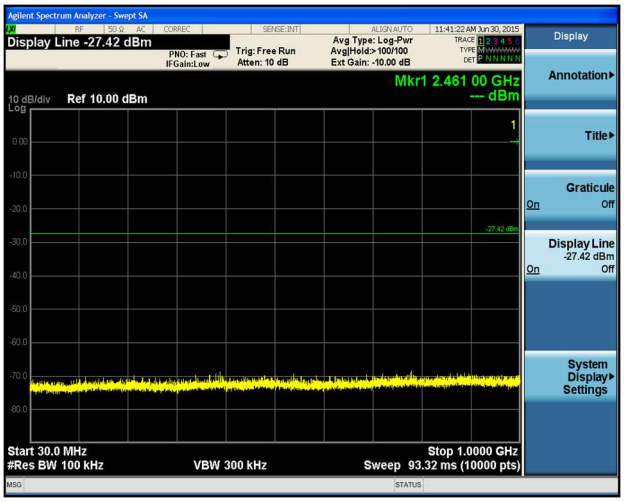
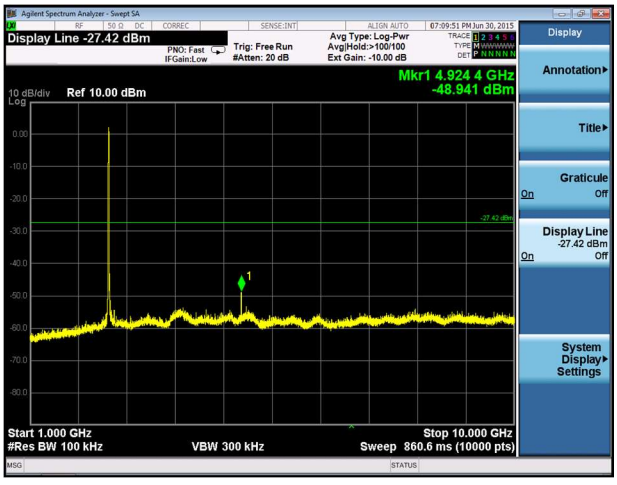
High Channel fundamental in 100 kHz:

30MHz to 1000MHz



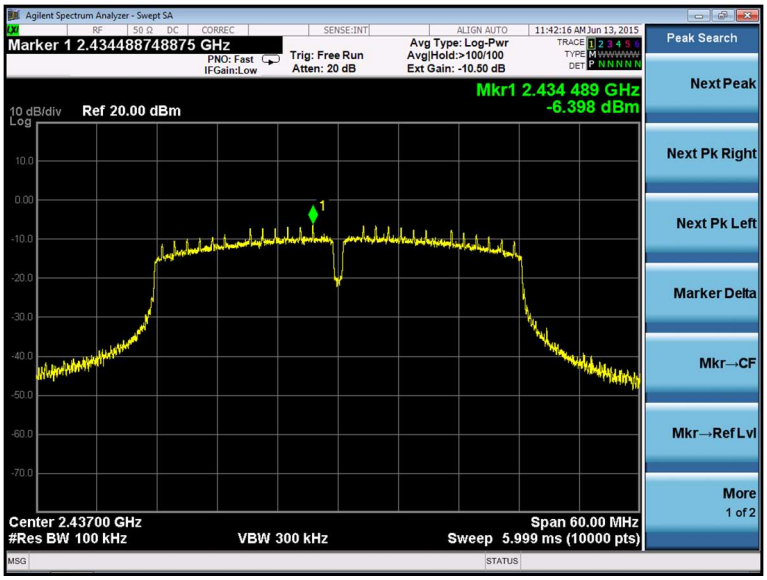
1000MHz to 10000MHz



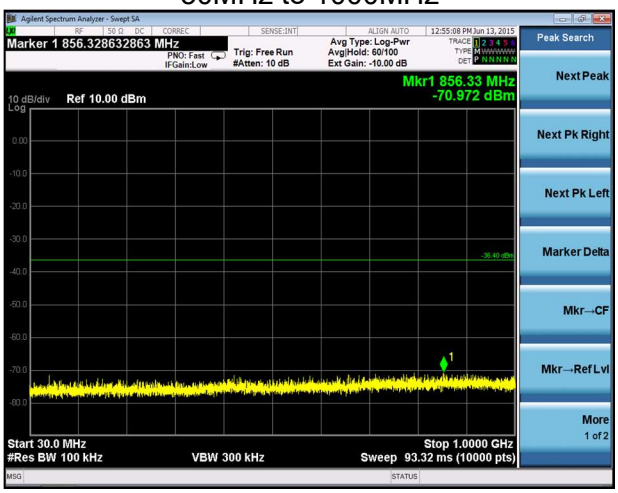
10000MHz to 25000MHz

HT40 (Only middle channel shown)

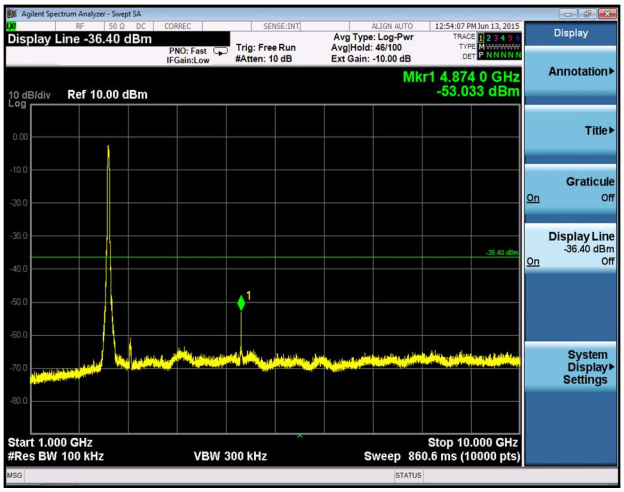
Middle Channel fundamental in 100 kHz:



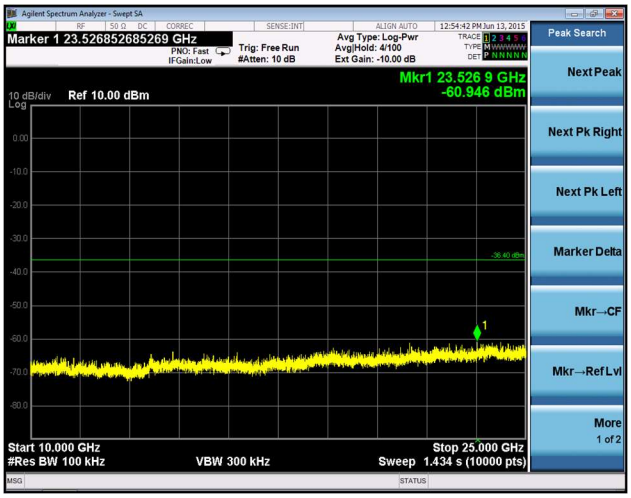
30MHz to 1000MHz



1000MHz to 10000MHz



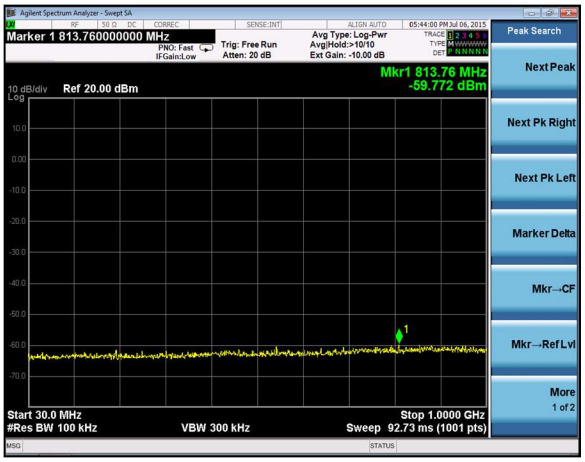
10000 to 25000MHz



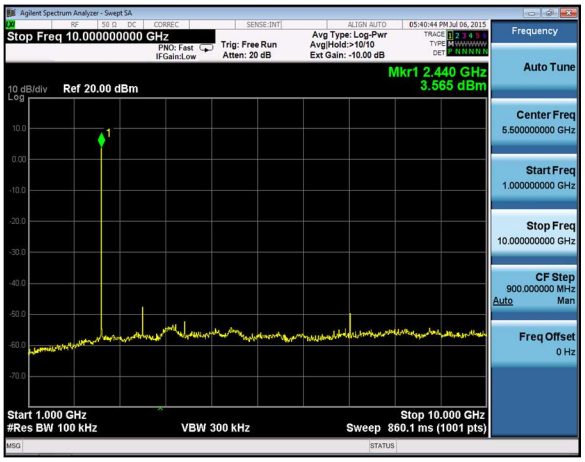
10.3.2 2.4GHz BLE
(Only middle channel shown)

Middle Channel fundamental in 100 kHz:

30MHz to 1000MHz



1000MHz to 10000MHz



10000MHz to 25000MHz

EXHIBIT 11. POWER SPECTRAL DENSITIES: 15.247(e)

11.1 Limits

For digitally modulate systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

In accordance with FCC Part 15.247(e) and RSS 210 A8.2(b), the peak power spectral density should not exceed +8 dBm in any 3 kHz band. This measurement was performed along with the conducted power output readings performed as described in previous sections. The peak output frequency for each representative frequency was scanned, with a narrow bandwidth, and reduced sweep, and a power density measurement was performed.

Measurement procedure used was FCC OET KDB 558074 D01 Measurement Guidance v03r03 section 10.1 for WLAN and BLE.

The data reported includes all necessary correction factors. These correction factors are loaded onto the EMI receiver when measurements are performed.

Reported Measurement data = Raw receiver measurement (dBm) + Cable factor (dB) + Miscellaneous factors when applicable (dB).

Generic example of reported data at 2440 MHz:

Reported Measurement data = 8.55 (raw receiver measurement in dBm) + 0.85 (cable factor in dB) = 9.4 (dBm).

11.2 Test Data

11.2.1 2.4GHz WLAN

802.11 Standard	Data Rate (MBPS)	Channel	PSD in 100kHz (dBm)	PSD in 3kHz limit(dBm)	PSD margin (dBm)
b	1 (DBPSK)	1	2.1	8.0	5.9
		6	2.4	8.0	5.6
		11	2.6	8.0	5.4
b	11 (8QPSK)	1	2.1	8.0	5.9
		6	2.5	8.0	5.5
		11	3.5	8.0	4.5
g	6 (BPSK)	1	-4.0	8.0	12.0
		6	-4.0	8.0	12.0
		11	-3.3	8.0	11.3
g	54 (64QAM)	1	-4.1	8.0	12.1
		6	-3.5	8.0	11.5
		11	-3.5	8.0	11.5
n (HT20)	MCS0 (BPSK)	1	-3.8	8.0	11.8
		6	-3.0	8.0	11.0
		11	-2.7	8.0	10.7
n (HT20)	MCS7 (64QAM)	1	-3.7	8.0	11.7
		6	-3.2	8.0	11.2
		11	-3.0	8.0	11.0
n (HT40)	MCS0 (BPSK)	3	-6.7	8.0	14.7
		6	-6.4	8.0	14.4
		9	-6.4	8.0	14.4
n (HT40)	MCS7 (64QAM)	3	-6.9	8.0	14.9
		6	-6.6	8.0	14.6
		9	-6.5	8.0	14.5

11.2.2 BLE

Data Rate (MBPS)	Channel (MHz)	Peak PSD in 100kHz (dBm)	PSD in 3kHz limit(dBm)	PSD margin (dBm)
1	2402	3.7	8.0	4.3
	2440	3.3	8.0	4.7
	2480	3.2	8.0	4.8

11.3 Screen Captures – Power Spectral Density

11.3.1 2.4GHz WLAN

11.3.1.1 1MBPS

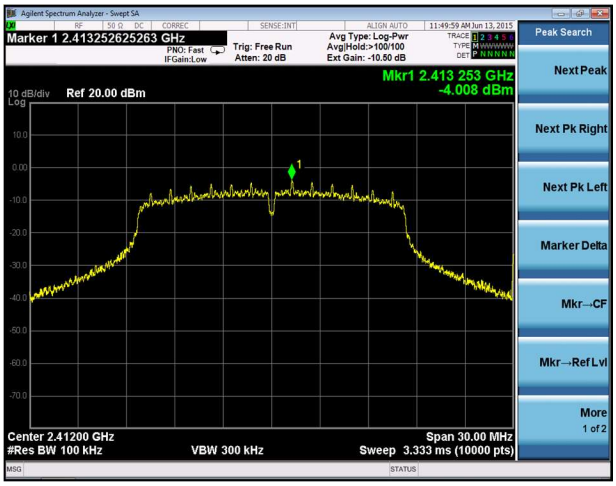
Low Channel

Middle Channel

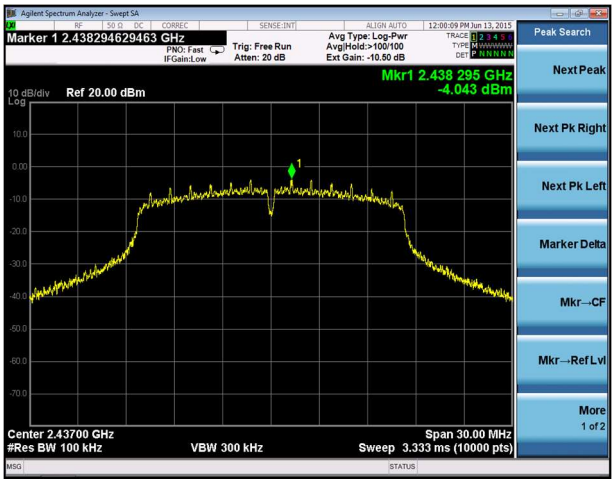
High Channel

11.3.1.2 6MBPS

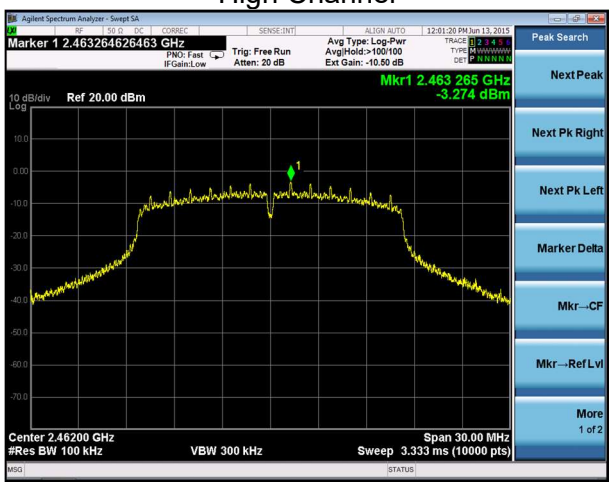
Low Channel



Middle Channel

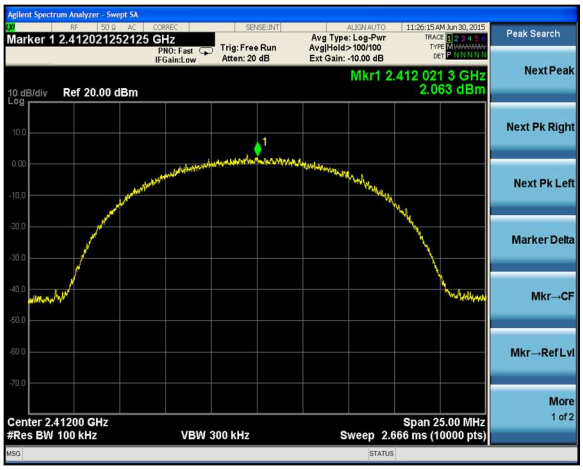


High Channel

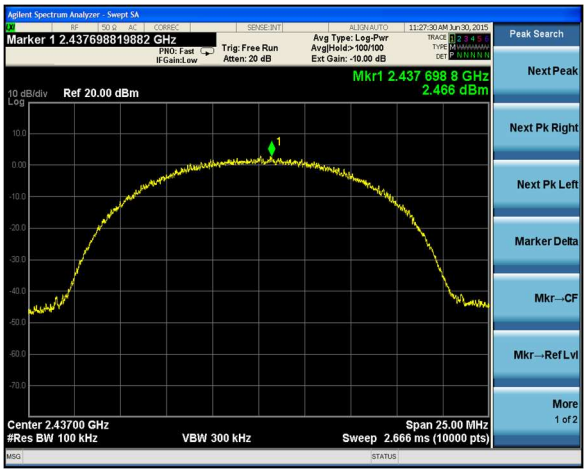


11.3.1.3 11MBPS

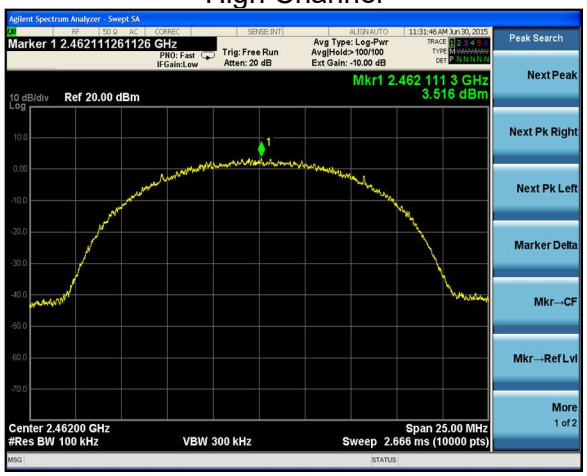
Low Channel



Middle Channel

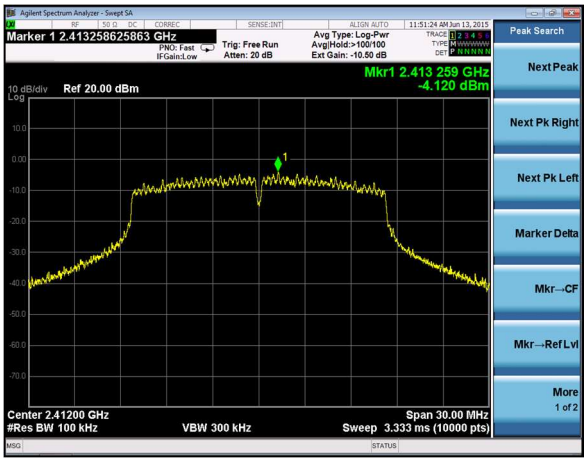


High Channel

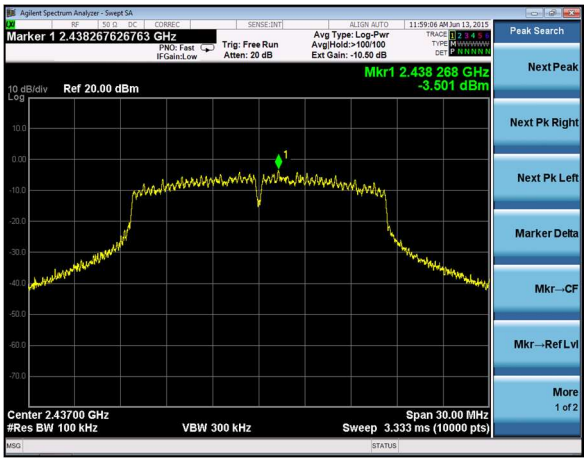


11.3.1.4 54MBPS

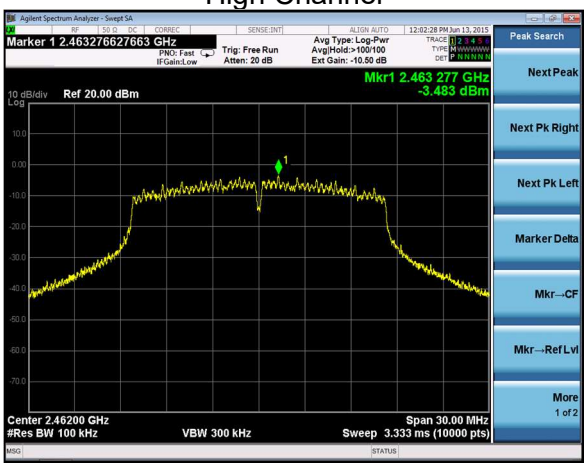
Low Channel



Middle Channel

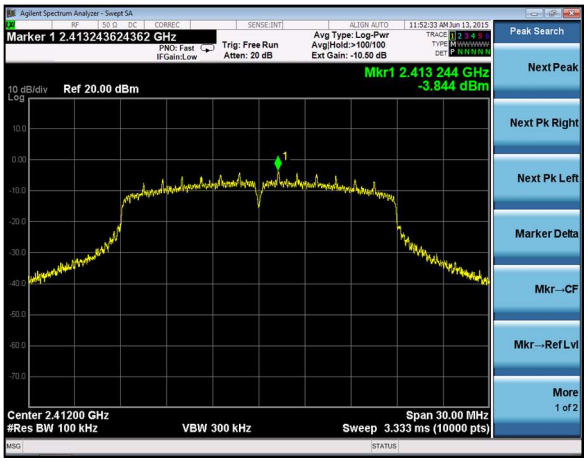


High Channel

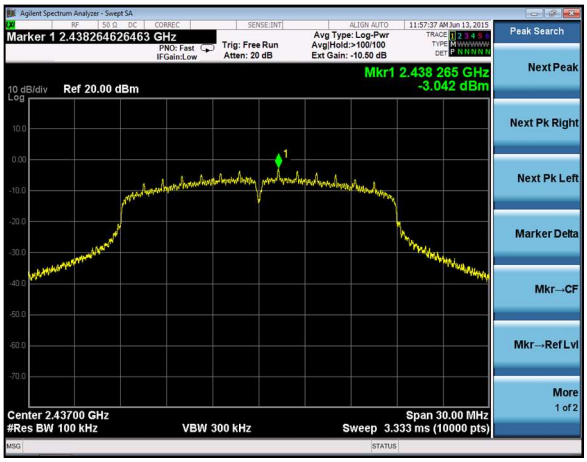


11.3.1.5 MCS0 HT20

Low Channel



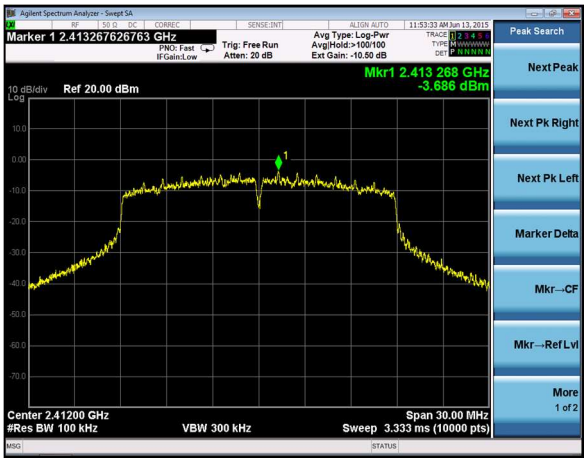
Middle Channel



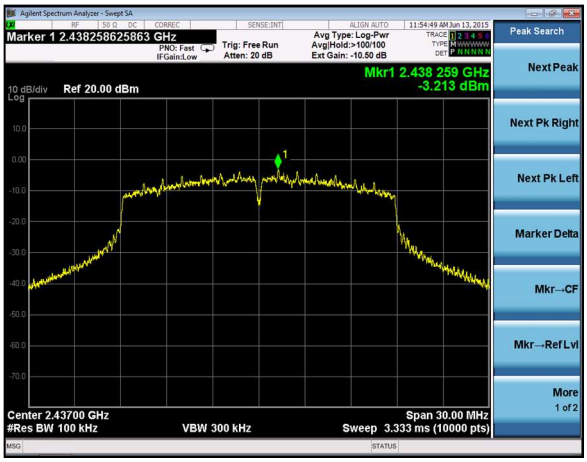
High Channel

11.3.1.6 MCS7 HT20

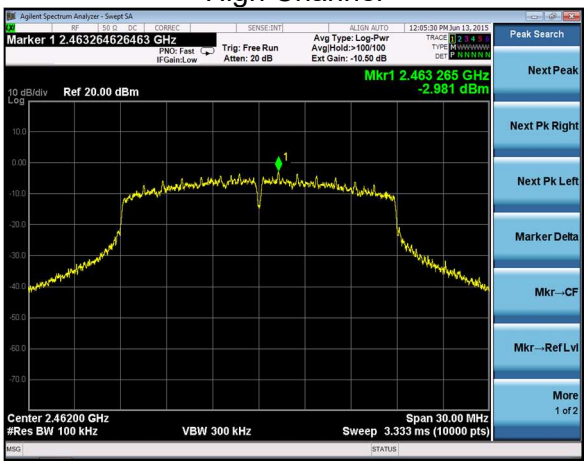
Low Channel



Middle Channel

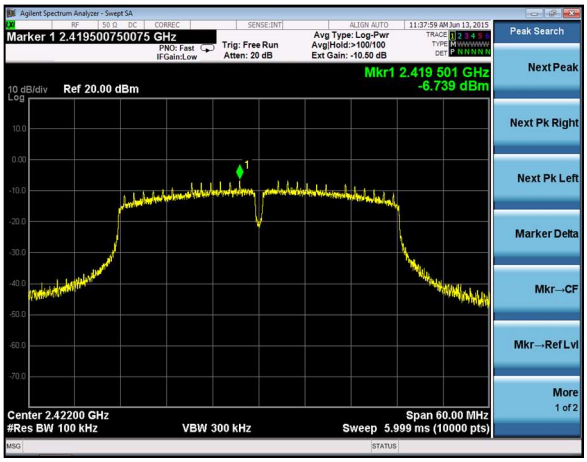


High Channel

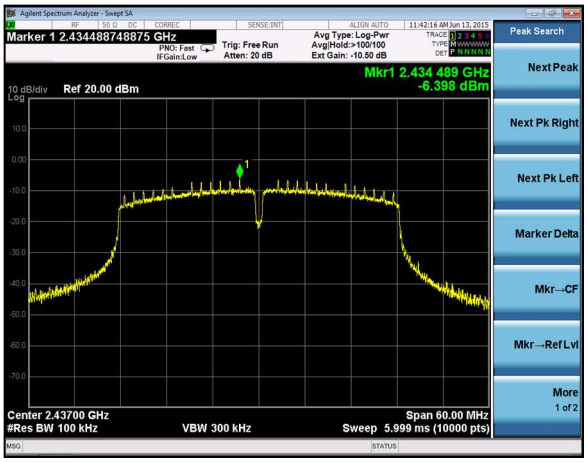


11.3.1.5 MCS0 HT40

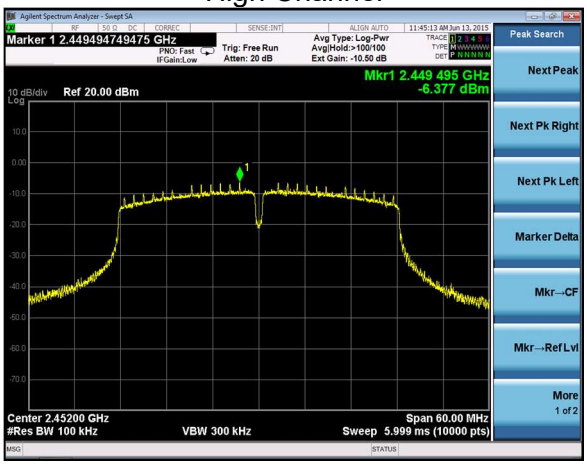
Low Channel



Middle Channel

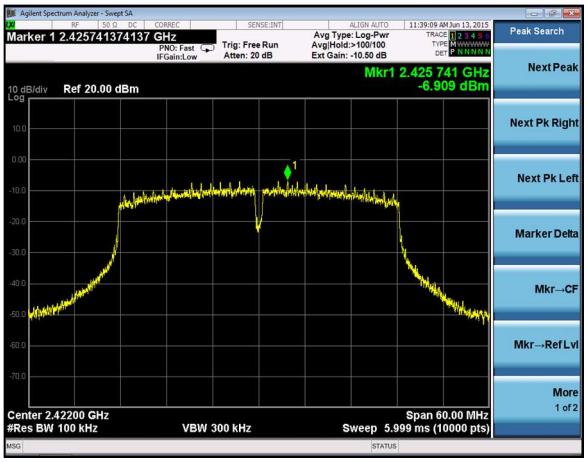


High Channel

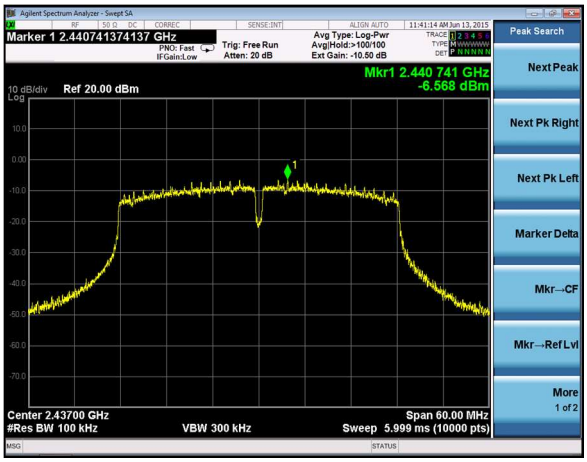


11.3.1.6 MCS7 HT40

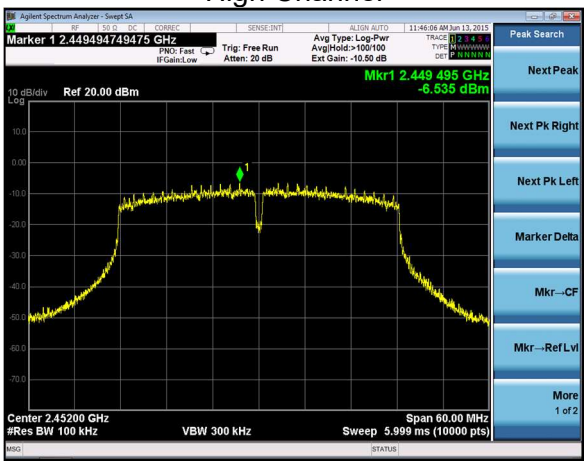
Low Channel



Middle Channel



High Channel



11.3.2 BLE

Low Channel

Middle Channel

High Channel

EXHIBIT 12. FREQUENCY STABILITY OVER VOLTAGE VARIATIONS

Test Engineer(s): Khairul Aidi Zainal

The frequency stability of the device was examined as a function of the input voltage available to the EUT. A Spectrum Analyzer was used to measure the RF output power and frequency at the appropriate frequency markers. Power was supplied by an external bench-type DC power supply and was varied ±10% from the nominal.

The power was then cycled On/Off to observe system response. No unusual response was observed, the emission characteristics were well behaved, and the system returned to the same state of operation as before the power cycle.

BLUETOOTH

	13.5VDC	15.0VDC	16.5VDC	
	FREQUENCY (Hz)	FREQUENCY (Hz)	FREQUENCY (Hz)	FREQ DRIFT (Hz)
LOW CHANNEL	2401995037	2401995053	2401995031	22
MID CHANNEL	2439994987	2439995007	2439994994	20
HIGH CHANNEL	2479994853	2479994851	2479994863	12

WLAN 2.4 GHZ

	13.5VDC	15.0VDC	16.5VDC	
	FREQUENCY (Hz)	FREQUENCY (Hz)	FREQUENCY (Hz)	FREQ DRIFT (Hz)
LOW CHANNEL	2411993790	2411993840	2411993896	106
MID CHANNEL	2436993620	2436993641	2436993704	84
HIGH CHANNEL	2461993910	2461993943	2461993994	84

EXHIBIT 13. COMPLIANCE TO KDB 594280 D01

To Whom It May Concern:

Regarding: Methods used for limiting WLAN transmit frequency range in the TiS10, TiS20, TiS40, TiS45, TiS50, TiS55, TiS60, TiS65 family of thermal imagers.
FCC ID:T68-FT65 IC ID: 6627A-FT65

The purpose of this letter is to describe the methods used to limit the operating frequency of the WLAN transmitter in the TiS series of thermal imagers. The operating channels are limited to channels 1 through 11 the 2.4GHz ISM band for 20MHz channel bandwidth, 1 through 7 for 40MHz high channel bandwidth, and 5 through 11 for 40MHz low channel bandwidth. These channel limitation are enforced using the following methods:

Restricted access to WLAN configuration tools:

As the device is configured from the factory, it is impossible for any third party (users, installers, integrators, service personnel, etc.) to gain access to any parameters through the user interface which can configure the device to operate on WLAN channels 12, 13, or 14. Furthermore, Fluke provides no means for a third party to configure the device through an authorized software modification or by network configuration to allow the device to operate on WLAN channels 12, 13, or 14. The only known means to access the parameters that configure access to WLAN channels 12, 13, or 14 is restricted through the use of an SSL cryptographic key. Access to this key is only provided to authorized personnel.

Use of the Linux Central Regulatory Domain Agent (CRDA) to enforce FCC regulatory permissions:

TiS series uses the Linux operating system, and implements CRDA to enforce FCC regulatory permissions. The wireless core driver (cfg80211) will only be allowed to initiate transmission on a given channel if the *entire channel bandwidth* is contained within the frequency range defined by the CRDA. For the TiS series, the allowed CRDA frequency range is coded in the firmware as a minimum of 2402MHz and a maximum of 2472MHz. For each operating mode, cfg80211 will only enable channels that fall completely within this range. Tables 1-3 define the enabled and disabled channels for the 20MHz (HT20), 40MHz low (HT40-) and 40MHz high (HT40+) operating modes.

WLAN Channel	Center frequency Of 20MHz channel (MHz)	Bandwidth at 20MHz (HT20) (MHz)	Channel availability for CRDA range 2402-2472 MHz
1	2412	2402-2422	Enabled
2	2417	2407-2427	Enabled
3	2422	2412-2432	Enabled
4	2427	2417-2437	Enabled
5	2432	2422-2442	Enabled
6	2437	2427-2447	Enabled
7	2442	2432-2452	Enabled
8	2447	2437-2457	Enabled
9	2452	2442-2462	Enabled
10	2457	2447-2467	Enabled
11	2462	2452-2472	Enabled
12	2467	2457-2477	Disabled (2477MHz > 2472 MHz)
13	2472	2462-2482	Disabled (2482MHz > 2472 MHz)
14	2484	2474-2494	Disabled (2494MHz > 2472 MHz)

Table 1: 20MHz (HT20)

WLAN Channel	Center frequency of 40MHz channel (MHz)	Bandwidth at 40MHz low (HT40-) (MHz)	Channel availability for CRDA range 2402-2472 MHz
1	2402	2382-2422	Disabled (2382MHz < 2402 MHz)
2	2407	2387-2427	Disabled (2387MHz < 2402 MHz)
3	2412	2392-2432	Disabled (2392MHz < 2402 MHz)
4	2417	2397-2437	Disabled (2397MHz < 2402 MHz)
5	2422	2402-2442	Enabled
6	2427	2407-2447	Enabled
7	2432	2412-2452	Enabled
8	2437	2417-2457	Enabled
9	2442	2422-2462	Enabled
10	2447	2427-2467	Enabled
11	2452	2432-2472	Enabled
12	2467	2437-2477	Disabled (2477MHz > 2472 MHz)
13	2472	2442-2482	Disabled (2482MHz > 2472 MHz)
14	2484	2454-2494	Disabled (2494MHz > 2472 MHz)

Table 2: 40MHz low (HT40-)

WLAN Channel	Center frequency of 40MHz channel (MHz)	Bandwidth at 40MHz high (HT40+) (MHz)	Channel availability for CRDA range 2402-2472 MHz
1	2422	2402-2442	Enabled
2	2427	2407-2447	Enabled
3	2432	2412-2452	Enabled
4	2437	2417-2457	Enabled
5	2442	2422-2462	Enabled
6	2447	2427-2467	Enabled
7	2452	2432-2472	Enabled
8	2447	2437-2477	Disabled (2477MHz > 2472 MHz)
9	2452	2442-2482	Disabled (2482MHz > 2472 MHz)
10	2457	2447-2487	Disabled (2487MHz > 2472 MHz)
11	2462	2452-2492	Disabled (2492MHz > 2472 MHz)
12	2467	2457-2497	Disabled (2497MHz > 2472 MHz)
13	2472	2462-2502	Disabled (2502MHz > 2472 MHz)
14	2484	2474-2514	Disabled (2514MHz > 2472 MHz)

Table 3: 40MHz high (HT40+)

A detailed description of the processing rules applied by the CRDA is available here:
https://wireless.wiki.kernel.org/en/developers/regulatory/processing_rules

The EUT does NOT have the ability to operate at different power levels. The power levels are set via firmware. This firmware is installed onto the radio module at the factory. The user has no access to any power level control.

In addition, the module EEPROM will be programmed at the factory to only operate and actively scan on these specific channels:

Channels 1 – 11, 2412-2462 MHz 802.11b mode
Channels 1 – 11, 2412-2462 MHz 802.11g mode
Channels 1 – 11, 2412-2462 MHz 802.11n mode (20 MHz channel)

The following channels will be programmed at the factory to passively scan and will only listen and cannot send a probe request to initiate communication on these specific channels. Ad-hoc mode is always disabled on these passive channels.

Channels 12 & 13, 2467 & 2472 MHz 802.11b mode
Channels 12 & 13, 2467 & 2472 MHz 802.11g mode
Channels 12 & 13, 2467 & 2472 MHz 802.11n mode (20MHz channel)

APPENDIX A – Test Equipment List

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 18-Jun-2015 Type Test : Conducted measurements Job # : C-2234

Prepared By: Aidi Customer : Fluke Thermography Quote #: 315160

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960087	44GHz EXA Spectrum Analyzer	Agilent	N9010A	MY53400296	12/11/2014	12/11/2015	Active Calibration
2	AA 960143	Phaseflex	Gore	EKD01D01048.0	5546519	6/14/2013	6/14/2015	Active Calibration
3	AA 960144	Phaseflex	Gore	EKD01D010720	5800373	Verification	Verification	System

Project Engineer: Quality Assurance: Peter Feiler

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 18-Jun-2015 Type Test : Radiated Measurements Job # : C-2234

Prepared By: Aidi Zainal Customer : Fluke Thermography Quote #: 315160

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	AA 960007	Double Ridge Horn Antenna	EMCO	3115	9311-4138	7/28/2014	7/28/2015	Active Calibration
2	EE 960125	SMA Cable	MegaPhase	NC19-S1S1-236	1GVT4 14032106 001	3/6/2015	3/6/2016	Active Verification
3	AA 960154	2.4GHz High Pass Filter	KWM	HPF-L-14186	7272-02	8/1/2014	8/1/2015	Active Calibration
4	EE 960160	0.8-21GHz LNA	Mini-Circuits	ZVA-213X-S+	977711030	7/28/2014	7/28/2015	Active Calibration
5	EE 960085	N9038A MXE 26.5GHz Receiver	Agilent	N9038A	MY51210148	5/6/2015	5/6/2016	Active Calibration
6	AA 960150	Biconical Antenna	ETS	3110B	0003-3346	1/22/2015	1/22/2016	Active Calibration
7	AA 960078	Log Periodic Antenna	EMCO	93146	9701-4855	1/19/2015	1/19/2016	Active Calibration
8	AA 960144	Phaseflex	Gore	EKD01D010720	5800373	Verification	Verification	System
9	EE 960146	Std. Gain Horn Ant. w/preamp	Adv. Micro / EMCO	WLA622-4 / 3160-09	123001	8/20/2014	8/20/2015	Active Calibration

Project Engineer: Quality Assurance: Peter Feiler

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 18-Jun-2015 Type Test : WLAN OBW Job # : C-2234

Prepared By: Aidi Customer : Fluke Thermography Quote #: 315160

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960085	N9038A MXE 26.5GHz Receiver	Agilent	N9038A	MY51210148	5/6/2015	5/6/2016	Active Calibration
2	EE 960089	LISN - 15A	COM-POWER	LI-215A	191943	3/2/2015	3/2/2016	Active Calibration

Project Engineer: Quality Assurance: Thomas T. Smith

Prepared For: Fluke Corporation	Model #: TiS10-65	Report #: 315160 A
EUT: TiS65	Serial #: Radiated: TiS65-15069005 Conducted:A15050019	LSR Job #: C-2234

APPENDIX B – Test Standards: CURRENT PUBLICATION DATES RADIO

STANDARD #	DATE	Am. 1	Am. 2
ANSI C63.4	2014		
ANSI C63.10	2013		
FCC 47 CFR, Parts 0-15, 18, 90, 95	2015		
RSS GEN	2014		
RSS 247	2015		

APPENDIX C - Uncertainty Statement

Table of Expanded Uncertainty Values, (K=2) for Specified Measurements

Measurement Type	*Particular Configuration*	*Uncertainty Values*
Radiated Emissions	*3 – Meter chamber, Biconical Antenna*	*4.82 dB*
Radiated Emissions	*3-Meter Chamber, Log Periodic Antenna*	*4.88 dB*
Radiated Emissions	*3-Meter Chamber, Horn Antenna*	*4.85 dB*
Radiated Emissions	*10-Meter OATS, Biconical Antenna*	*4.32 dB*
Radiated Emissions	*10-Meter OATS, Log Periodic Antenna*	*3.63 dB*
Absolute Conducted Emissions	*Agilent PSA/ESA Series*	*1.38 dB*
AC Line Conducted Emissions	*Shielded Room/EMCO LISN*	*3.20 dB*
Radiated Immunity	*3 Volts/Meter in 3-Meter Chamber*	*2.05 Volts/Meter*
Conducted Immunity	*3 Volts level*	*2.33 V*
EFT Burst, Surge, VDI	*230 VAC*	*54.4 V*
ESD Immunity	*Discharge at 15kV*	*3200 V*
Temperature/Humidity	*Thermo-hygrometer*	*0.64° / 2.88 %RH*

APPENDIX D –Bluetooth and WLAN Coexistence

(Information presented below was referenced from TI WILink 8 Software specification, document SWRU423 section 2.10)

Both WLAN and BT operate on a 2.4-GHz ISM band. Allowing the two technologies to work simultaneously, especially when located on the same device, is a challenging task that requires special treatment to keep performance quality on both sides. The advantage of having both Wi-Fi and BT/BLE on a single combo device such as WiLink8.0 provides better correlation between the different IPs to ensure good performance. WiLink8.0 uses a shared antenna for Wi-Fi and BT.

This operation is accomplished by managing a time-division multiplexing (TDM) scheme; transmitting and receiving independent signals over the shared antenna in an alternating pattern, using an external controlled switch.

The WLAN both switches the antenna to the BT IP and protects BT traffic from any WLAN traffic by other devices, using a number of different methods.

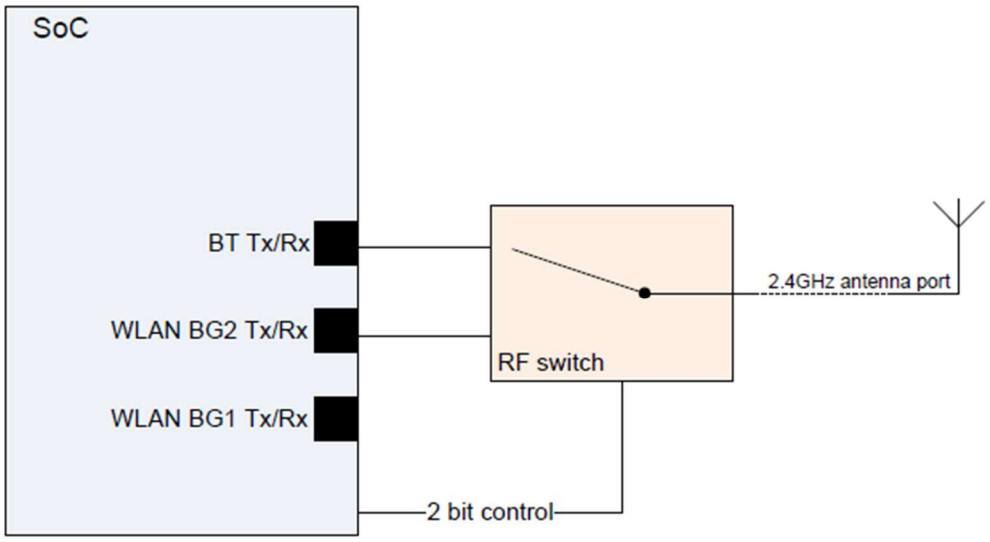


Figure 4. Wi-Fi – BT/BLE Coexistence – Shared Antenna