

EMC Test Report

Project Number: 4222155

Report Number: 4222155EMC07

Revision Level: 0

Client: Tyco Safety Products/Sensormatic

Equipment Under Test: Business Intelligence Module

Model: BIM1000

FCC ID: BVCBIM1000

IC ID: 3506A-BIM1000

Applicable Standards: ANSI C63.10: 2013 (FCC Part 15 Subpart C, § 15.247)

RSS-247, Issue 2

RSS-GEN, Issue 4

Report issued on: 12 February 2018

Test Result: Compliant

Tested by:


Shawn McGuinness, EMC Engineering Leader

Reviewed by:


David Schramm, Operations Manager

Remarks: This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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1 Summary of Test Results

Test Description	Test Specification		Test Result
Bandwidth	15.247(d)	RSS-247 S5.2 (1) RSS-GEN S6.6	Compliant
Transmitter Output Power	15.247(b)(3)	RSS-247 S5.4 (4)	Compliant
Power Spectral Density	15.247(e)	RSS-247 S5.2 (2)	Compliant
Conducted Spurious Emissions / Band edge	15.247(d)	RSS-247 S5.5	Compliant
Radiated Spurious Emissions / Restricted Bands	15.35(b),15.209	RSS-GEN S6.13 RSS-GEN S8.10	Compliant
AC Powerline Conducted Emission	15.107, 15.207	RSS-GEN S8.8	Compliant
Antenna Requirement	15.203	RSS-GEN S8.3	Compliant (1)

1) The device has an external detachable antenna with a Reverse Polarity SMA connector.

1.1 Modifications Required for Compliance

None

2 General Information

2.1 Client Information

Name: Tyco Retail Solutions
Address: 6600 Congress Avenue
City, State, Zip, Country: Boca Raton, FL 33487, USA

2.2 Test Laboratory

Name: SGS North America, Inc.
Address: 620 Old Peachtree Road NW, Suite 100
City, State, Zip, Country: Suwanee, GA 30024, USA

Accrediting Body: A2LA
Type of lab: Testing Laboratory
Certificate Number: 3212.01

2.3 General Information of EUT

Type of Product: Business Intelligence Module
Model Number: BIM1000
Serial Number: Not Labeled

Frequency Range: 2405-2475MHz
Modulation: 802.15.4
Antenna: 3.8dBi monopole

Rated Voltage: 18VDC 1.7A
Test Voltage: 18VDC 1.7A

Sample Received Date: 20 October 2017
Dates of testing: 23 October to 31 October 2017

2.4 Operating Modes and Conditions

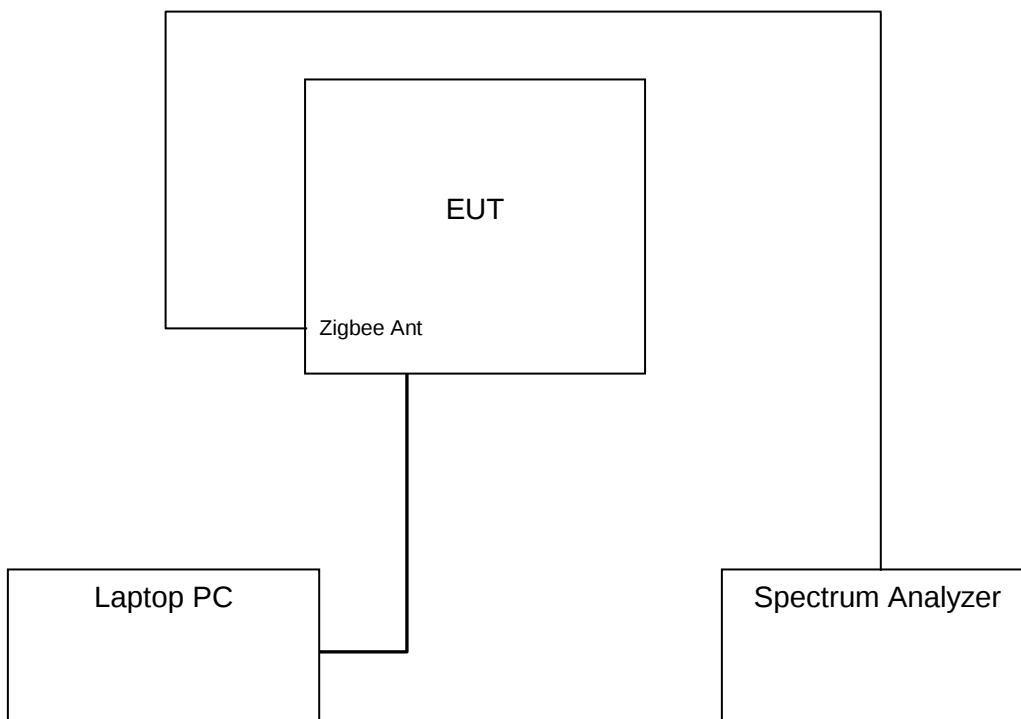
Continuous traffic was generated using test commands. The device was programmed to transmit at 100% duty cycle at low, middle, and high channels.

Channel 11, 2405MHz

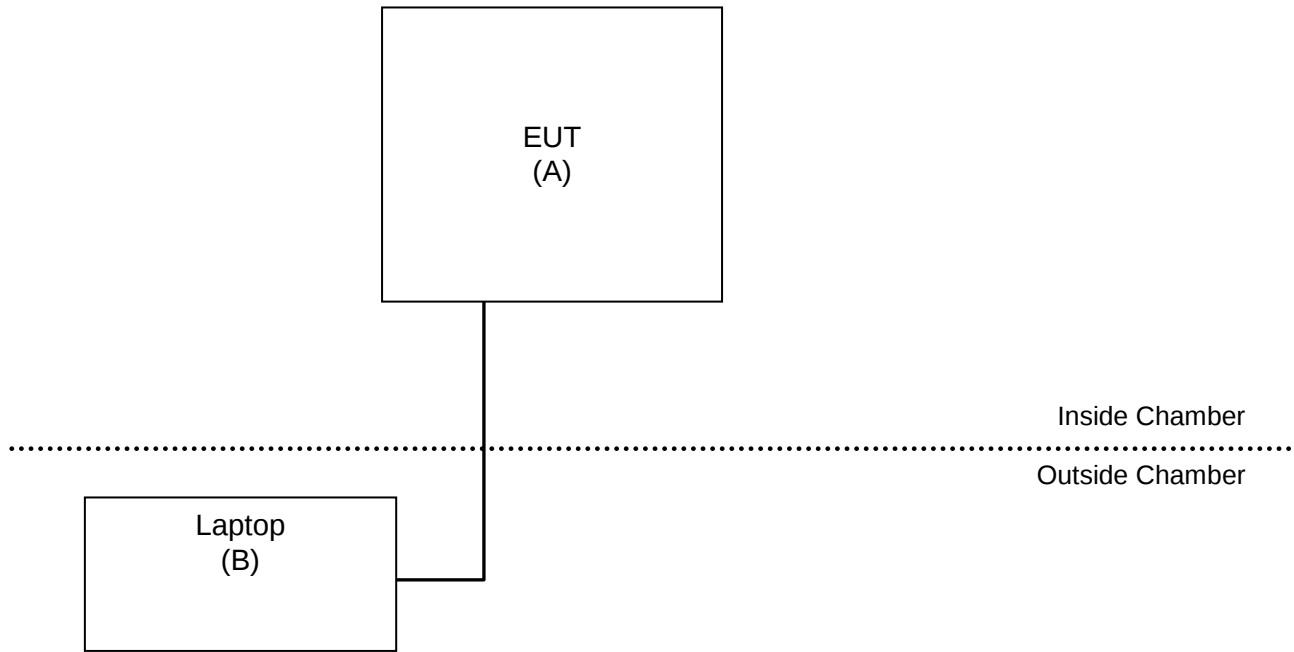
Channel 18, 2440MHz

Channel 25, 2475MHz

2.5 EUT Connection Block Diagram – Conducted Measurements



2.6 EUT Connection Block Diagram – Radiated Measurements



2.7 System Configurations

Device reference	Manufacturer	Description	Model Number	Serial Number
A	Tyco	Business Intelligence Module	BIM1000	Not Labeled
B	H/P	Laptop PC(Client)	15-21233wm	5CD6415H9V

3 Bandwidth

3.1 Test Result

Test Description	Test Specification		Test Result
6 dB bandwidth / 99% OBW	15.247(d)	RSS-247 S5.2 (1) RSS-GEN S6.6	Compliant

3.2 Test Method

The procedures from ANSI C63.10: 2013 clause 11.8 and 558074 D01 DTS Measurement Guidance v04 were used to determine the 6 dB bandwidth and 99% OBW.

3.3 Test Site

3m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

Environmental Conditions

Temperature: 23.2 °C

Relative Humidity: 47.5 %

3.4 Test Equipment

Test End Date: 24-Oct-2017

Tester: SKM

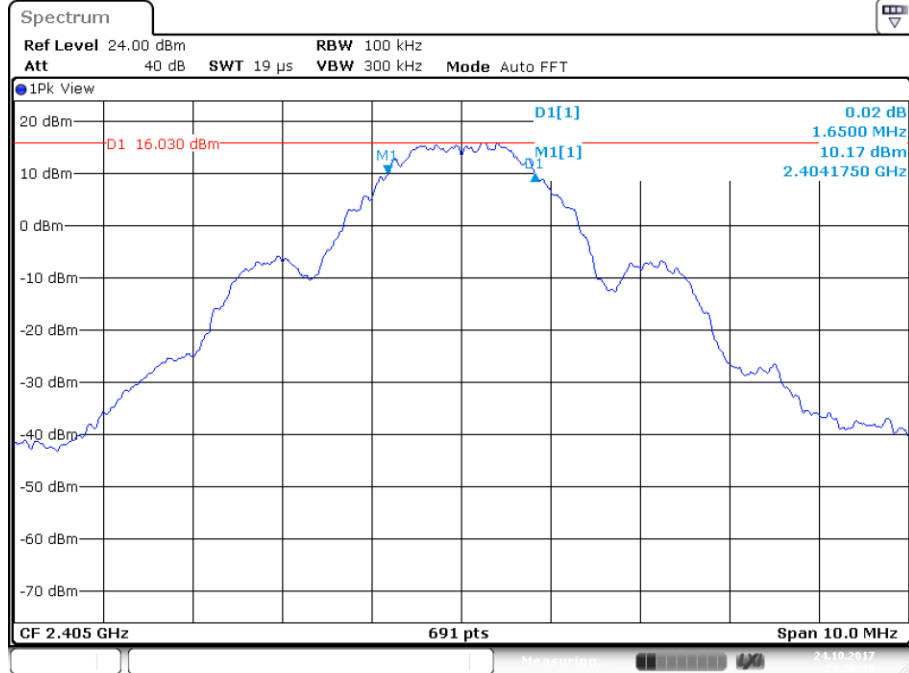
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Signal Analyzer	FSV-30	Rohde & Schwarz	Rental	28-Sep-2018
RF CABLE	SF102	HUBER & SUHNER	B079823	26-Jul-2018

Note: The equipment calibration period is 1 year except for the FSV which is on a 2-year calibration cycle.

3.5 Test Data

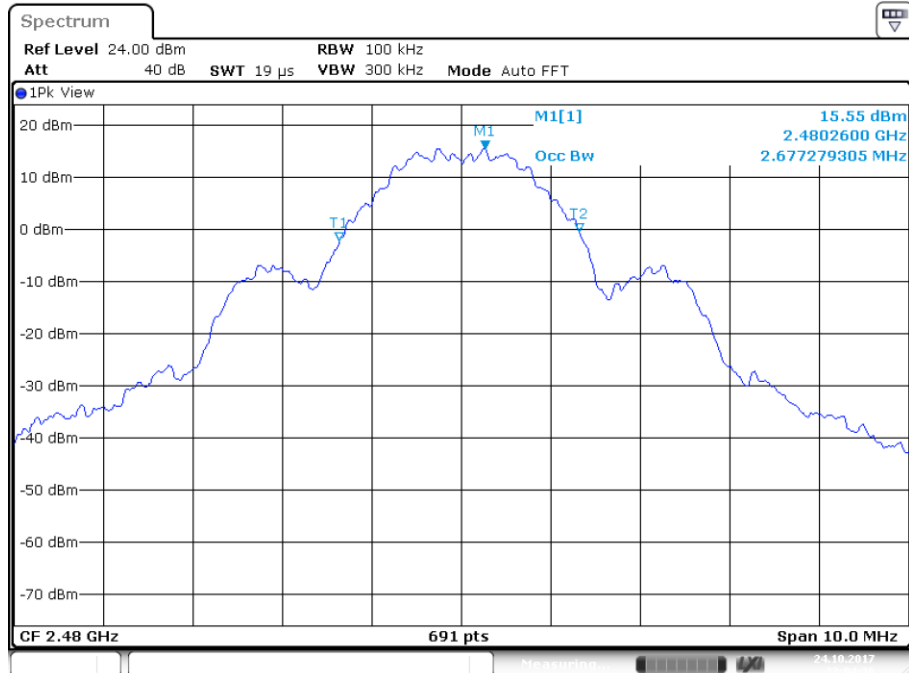
Channel	6dB Bandwidth (MHz)	Occupied Bandwidth (99%) (MHz)
11	1.65	2.691
18	1.635	2.677
25	1.621	2.677

Sample Plot for 6 dB bandwidth



Date: 24.OCT.2017 21:56:39

Sample Plot for 99% bandwidth



Date: 24.OCT.2017 22:04:36

4 Output Power

4.1 Test Result

Test Description	Test Specification		Test Result
Peak Output Power	15.247(b) (3)	RSS-247 S5.4 (4)	Compliant

4.2 Test Method

Fundamental power measurements were recorded using the peak power procedures from ANSI C63.10: 2013 clause 11.9 and KDB 558074 D01 Measurement Guidance v04.

Limit

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. For using antennas with greater than 6dBi of gain, the limit is reduced in dB by the amount the gain exceeds 6dBi

4.3 Test Site

3m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

Environmental Conditions

Temperature: 23.2 °C
Relative Humidity: 47.5 %

4.4 Test Equipment

Test End Date: 24-Oct-2017

Tester: SKM

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Signal Analyzer	FSV-30	Rohde & Schwarz	Rental	28-Sep-2018
RF CABLE	SF102	HUBER & SUHNER	B079823	26-Jul-2018

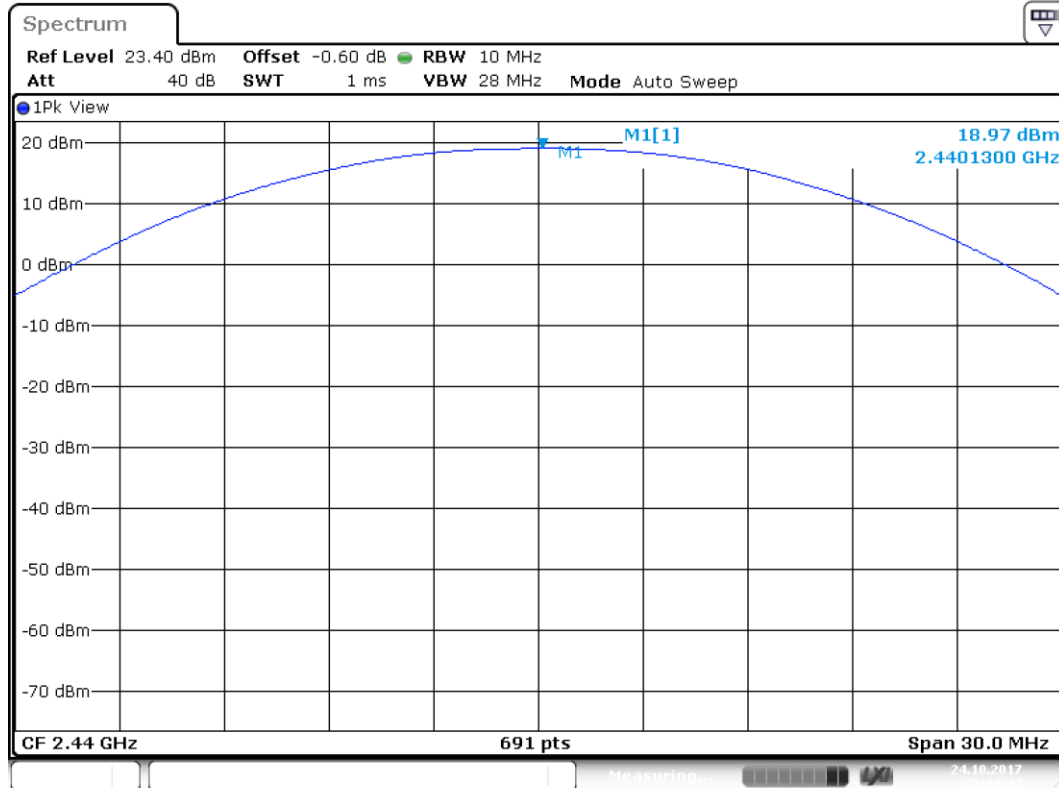
Note: The equipment calibration period is 1 year except for the FSV which is on a 2-year calibration cycle.

Because the measured RF output power at nominal temperature and voltage was less than 10dBm EIRP, it was not necessary to perform power spectral density measurements.

4.5 Test Data

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (30dBm)	Margin (dB)
11	2405	19.43	30	-10.57
18	2440	18.97	30	-11.03
25	2475	18.43	30	-11.57

Sample Plot



Date: 24.OCT.2017 22:19:13

5 Power Spectral Density

5.1 Test Result

Test Description	Test Specification		Test Result
Power Spectral Density	15.247(e)	RSS-247 S5.2 (2)	Compliant

5.2 Test Method

Power spectral density measurements were recorded using the peak PSD procedures from ANSI C63.10: 2013 clause 11.10 and KDB 558074 D01 Measurement Guidance v04.

Limit

The limit is 8 dBm.

5.3 Test Site

3m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

Environmental Conditions

Temperature: 23.2 °C

Relative Humidity: 51.5 %

5.4 Test Equipment

Test End Date: 24-Oct-2017

Tester: SKM

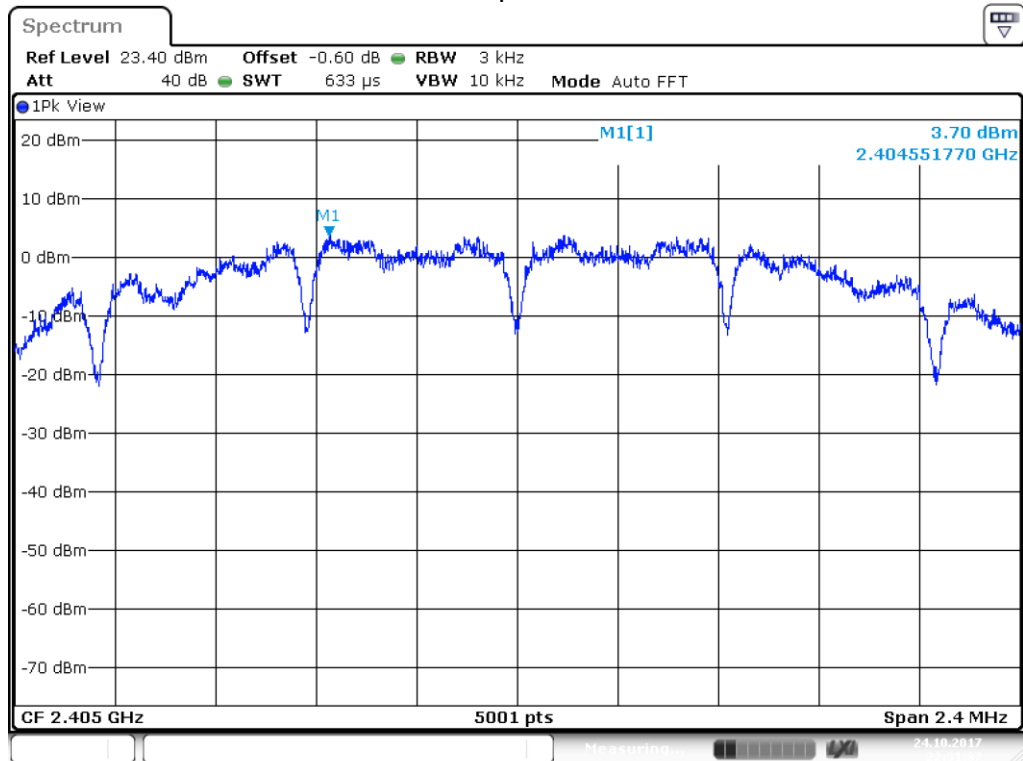
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Signal Analyzer	FSV-30	Rohde & Schwarz	Rental	28-Sep-2018
RF CABLE	SF102	HUBER & SUHNER	B079823	26-Jul-2018

Note: The equipment calibration period is 1 year except for the FSV which is on a 2-year calibration cycle.

5.5 Test Data

Channel	Frequency (MHz)	Peak PSD (dBm)	Limit (8dBm)	Margin (dB)
11	2405	3.7	8	-4.3
18	2440	3.42	8	-4.58
25	2475	3.56	8	-4.44

Sample Plot



Date: 24.OCT.2017 22:31:37

6 Conducted Spurious Emissions

6.1 Test Result

Test Description	Test Specification		Test Result
Conducted Spurious Emissions	15.247(d)	RSS-247 S5.5	Compliant

6.2 Test Method

Spurious emissions in non-restricted frequency bands were recorded using the methods defined in ANSI C63.10: 2013 clause 11.11 and KDB 558074 D01 Measurement Guidance v04.

Lowest, middle, and highest channels were investigated. Only the worst-case (lowest data rate) for each modulation was reported. Antenna Port 2 yielded the higher output power levels and was used for conducted spurious measurements. The maximum target power was used (20dBm).

Because the maximum conducted peak output power was used to determine compliance with the output power limits, the limit is 20 dB below the maximum in-band peak PSD level in 100 kHz.

6.3 Test Site

3m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

Environmental Conditions

Temperature: 23.2 °C

Relative Humidity: 47.5 %

6.4 Test Equipment

Test End Date: 24-Oct-2017

Tester: SKM

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Signal Analyzer	FSV-30	Rohde & Schwarz	Rental	28-Sep-2018
RF CABLE	SF102	HUBER & SUHNER	B079823	26-Jul-2018

Test End Date: 26-Oct-2017

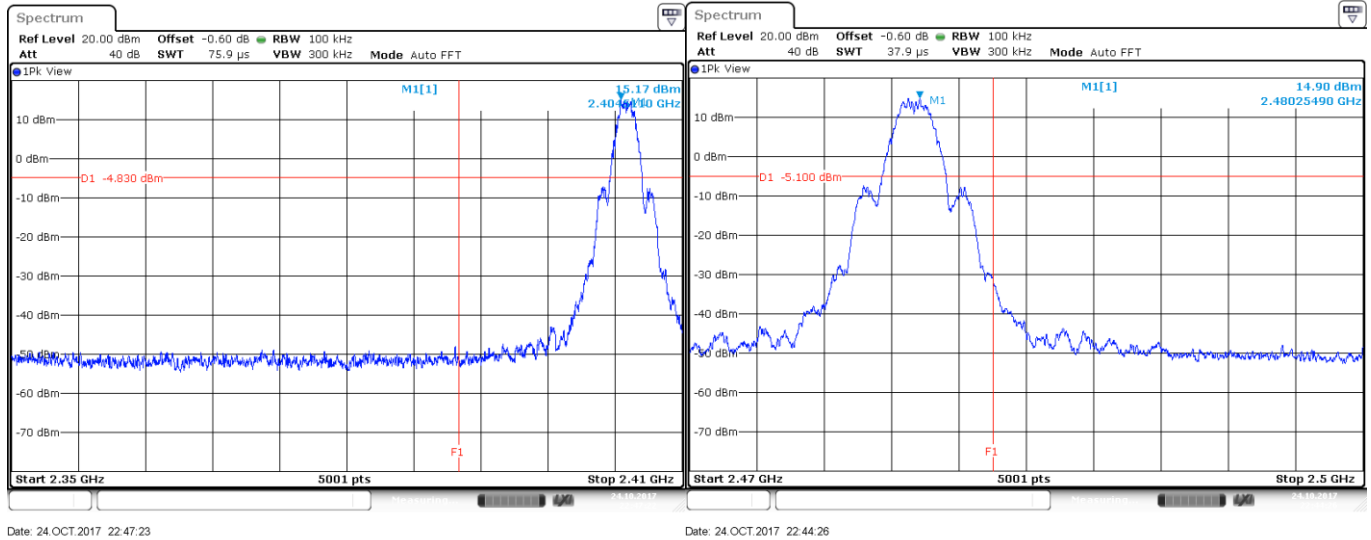
Tester: SKM

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Signal Analyzer	FSV-30	Rohde & Schwarz	Rental	28-Sep-2018
RF CABLE	SF102	HUBER & SUHNER	B079823	26-Jul-2018

Note: The equipment calibration period is 1 year except for the FSV which is on a 2-year calibration cycle.

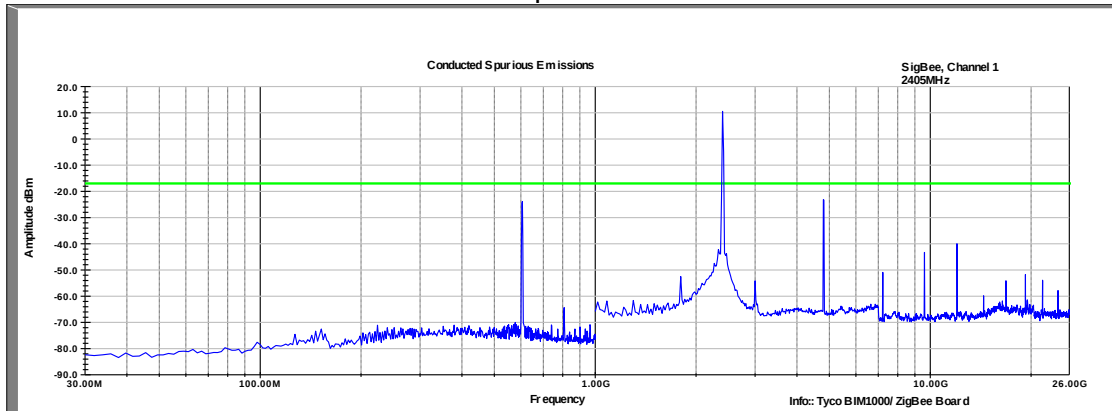
6.5 Test Data – DTS Bandedge

Lower band edge / Upper band edge

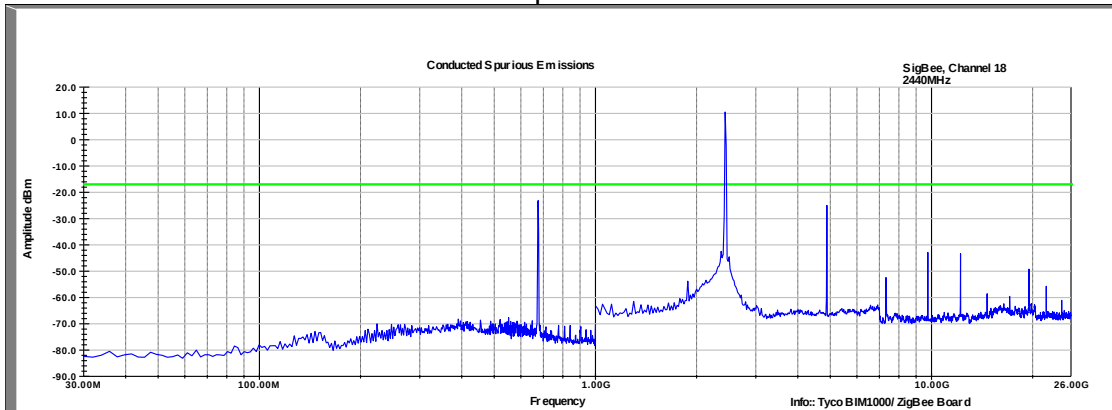


6.6 Test Data – Conducted Spurious Emissions

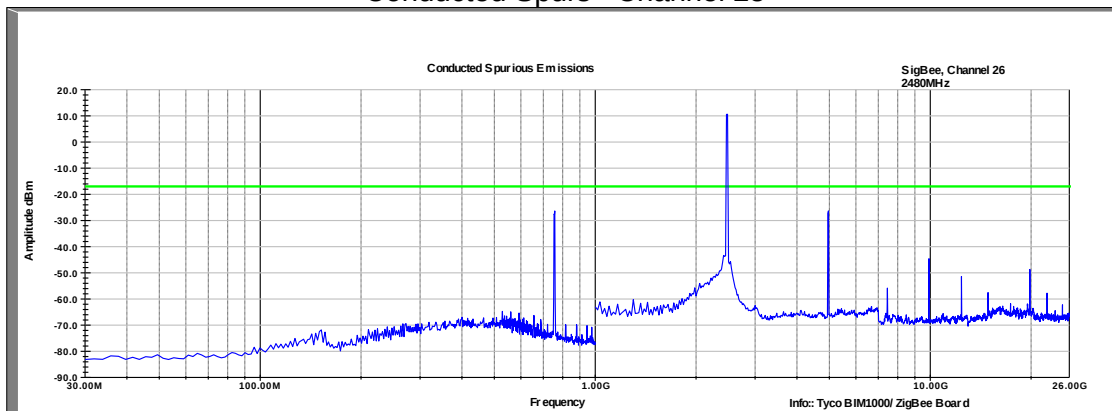
Conducted Spurs –Channel 11



Conducted Spurs –Channel 18



Conducted Spurs –Channel 25



7 Field Strength of Spurious Radiation

7.1 Test Result

Test Description	Test Specification		Test Result
Spurious Emissions	15.247 (d) and 15.209	RSS-247 S5.5	Compliant

7.2 Test Method

Radiated emission measurements were performed with the chip antennas installed as intended. The measurement methods defined in ANSI C63.4: 2014 were used.

Lowest, middle, and highest channels were investigated.

Test distance:

9k to 30 MHz – Near field pre-scan to determine if there were any emissions

30 to 1000 MHz - The EUT to measurement antenna distance was 3 meters

1 to 18 GHz - The EUT to measurement antenna distance was 3 meters

18 to 26 GHz - The EUT to measurement antenna distance was 1 meter

Limits within restricted bands of operation:

Frequency	Limits ⁽¹⁾		Peak Limits dBuV/m
	Microvolts/m	dBuV/m	
30 - 88 MHz	100	40 ⁽²⁾	--
88 - 216 MHz	150	43.5 ⁽²⁾	--
216 - 960 MHz	200	46 ⁽²⁾	--
960 - 1000 MHz	500	54 ⁽²⁾	--
1 - 40 GHz	500	54 ⁽³⁾	74

(1) These limits are applicable to emissions outside of the intentional transmit frequency band.

(2) Quasi-peak limit

(3) Average limit

7.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.4 °C

Relative Humidity: 49.5 %

7.4 Test Equipment

Test End Date: 26-Oct-2017

Tester: SKM

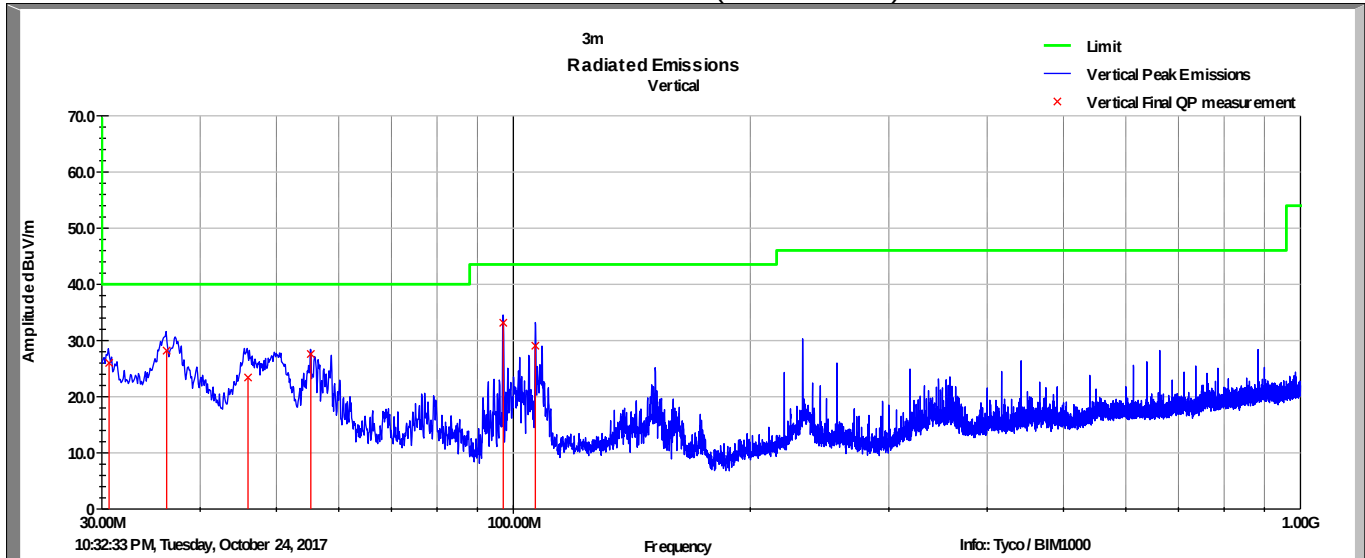
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
FILTER, HIGH PASS (>2400MHZ)	HPM50110	MICRO-TRONICS	B079792	27-Jul-2018
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	25-Apr-2018
ANTENNA, BILOG	CBL 6143A	TESEQ	B085931	6-Dec-2017
RF CABLE	SF106	HUBER & SUHNER	B079661	25-Jul-2018
RF CABLE	SF106	HUBER & SUHNER	B079713	24-Jul-2018
RF CABLE	SF106	HUBER & SUHNER	B079716	24-Jul-2018
RF CABLE	SUCOFLEX 100	HUBER & SUHNER	B108523	24-Jul-2018
RF CABLE	SF102	HUBER & SUHNER	B079822	27-Jul-2018
RF CABLE	SF102	HUBER & SUHNER	B079824	26-Jul-2018
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	B094463	22-Feb-2018
ANTENNA, DRG HORN (MEDIUM)	3117	ETS LINDGREN	B079691	27-Jul-2018
HORN(SMALL)	LB-180400-20-C-KF	A-INFO	15007	21-Mar-2018
LOW NOISE AMPLIFIER	NSP1840-HG	MITEQ	B087572	28-Jul-2018
FILTER, BAND REJECT (2450MHZ)	BRM50709	MICRO-TRONICS	B079790	27-Jul-2018

Note: The equipment calibration period is 1 year.

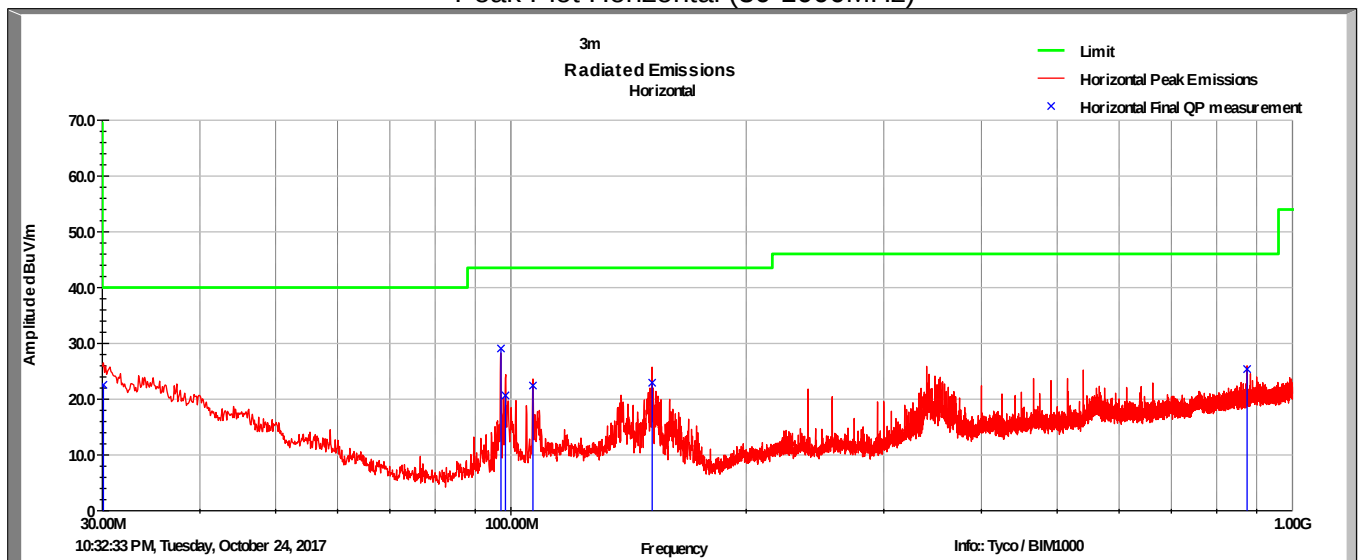
7.5 Test Data – Peak Plots

No emissions detected below 30MHz

Low Channel)
Peak Plot Vertical (30-1000MHz)

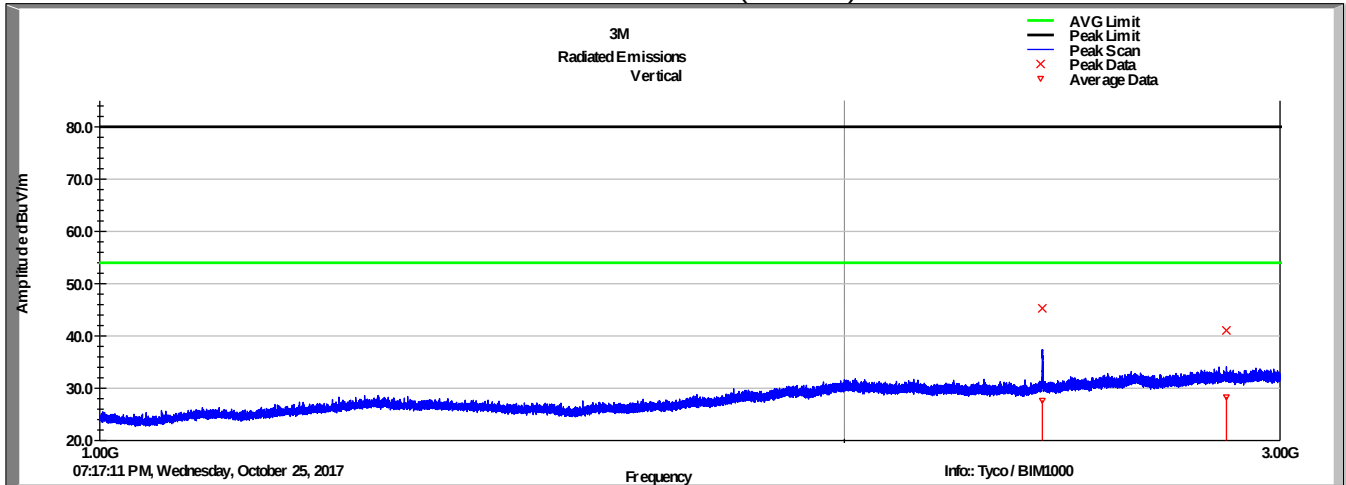


Low Channel (Channel 11, 2405MHz)
Peak Plot Horizontal (30-1000MHz)



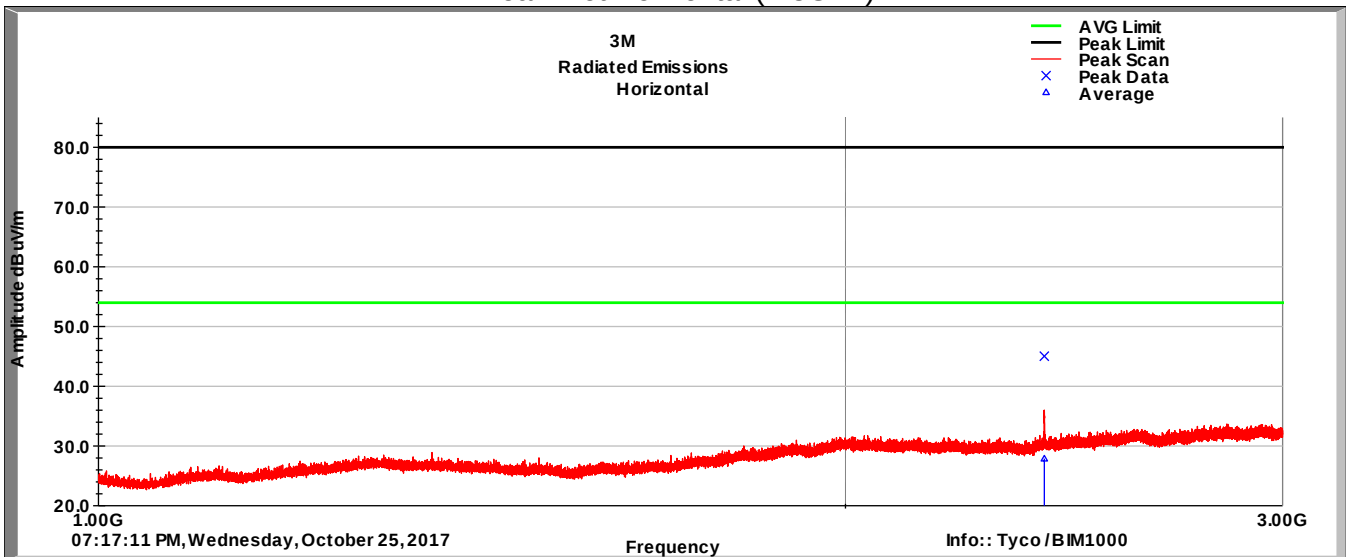
Note: There was no change in the emission profile below 1GHz when switching among Channels 11, 18, and 25.

Low Channel Peak Plot Vertical (1-3GHz)



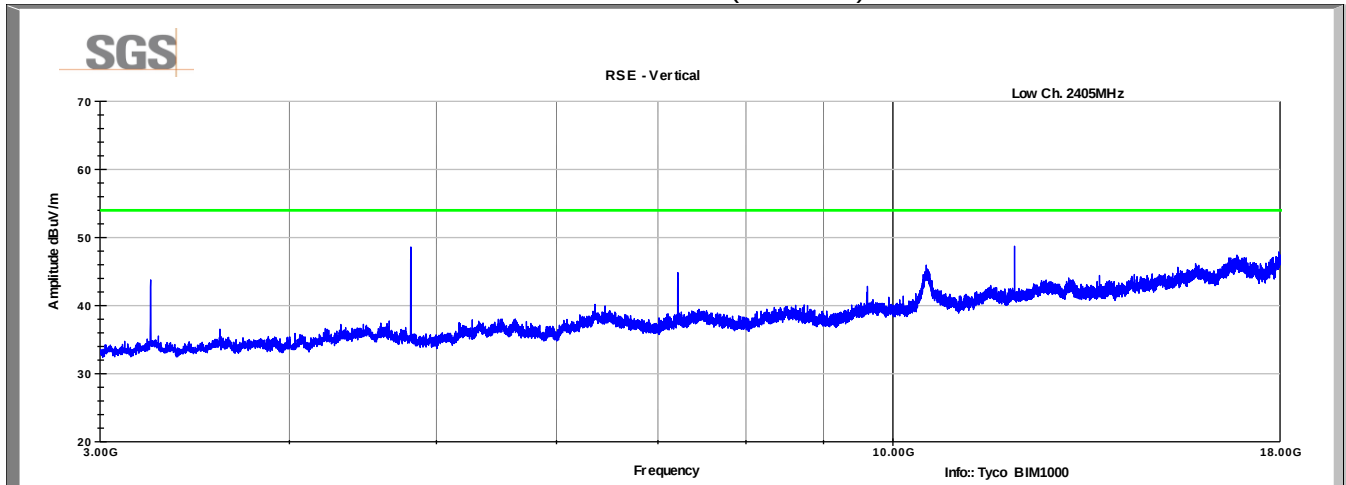
Note: 2.4GHz Band Reject filter in place

Low Channel Peak Plot Horizontal (1-3GHz)

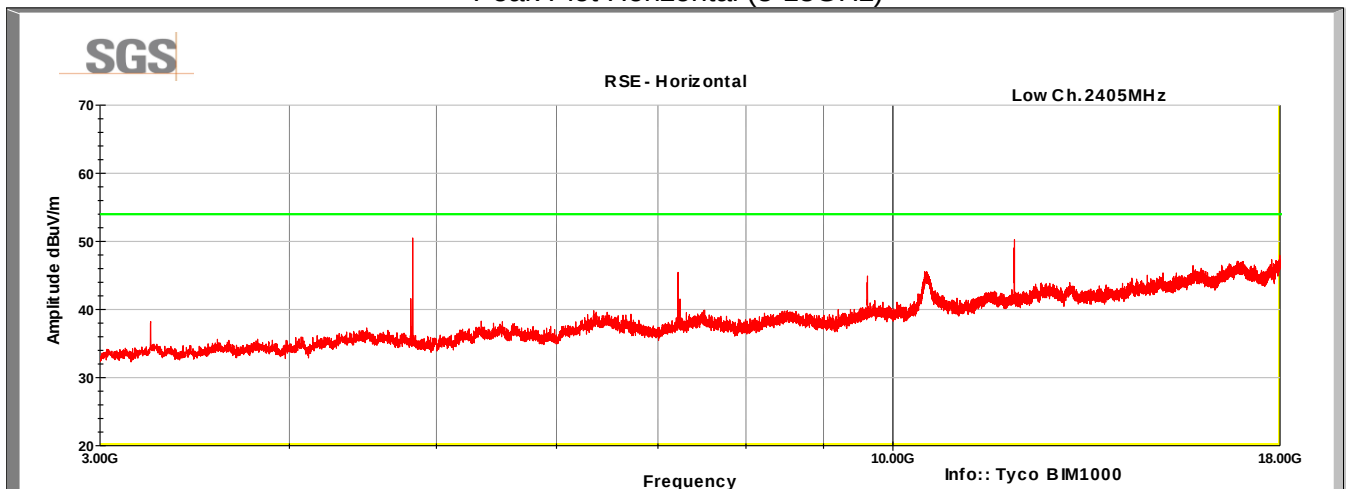


Note: 2.4GHz Band Reject filter in place

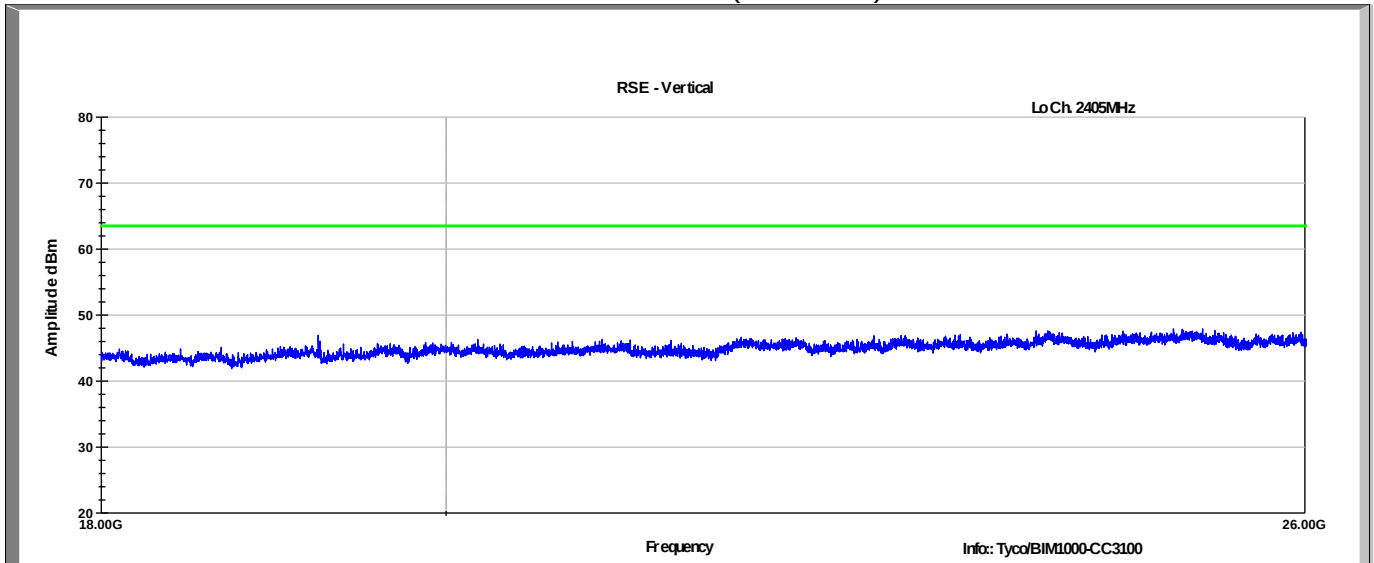
Low Channel (Channel 11, 2405MHz) Peak Plot Vertical (3-18GHz)



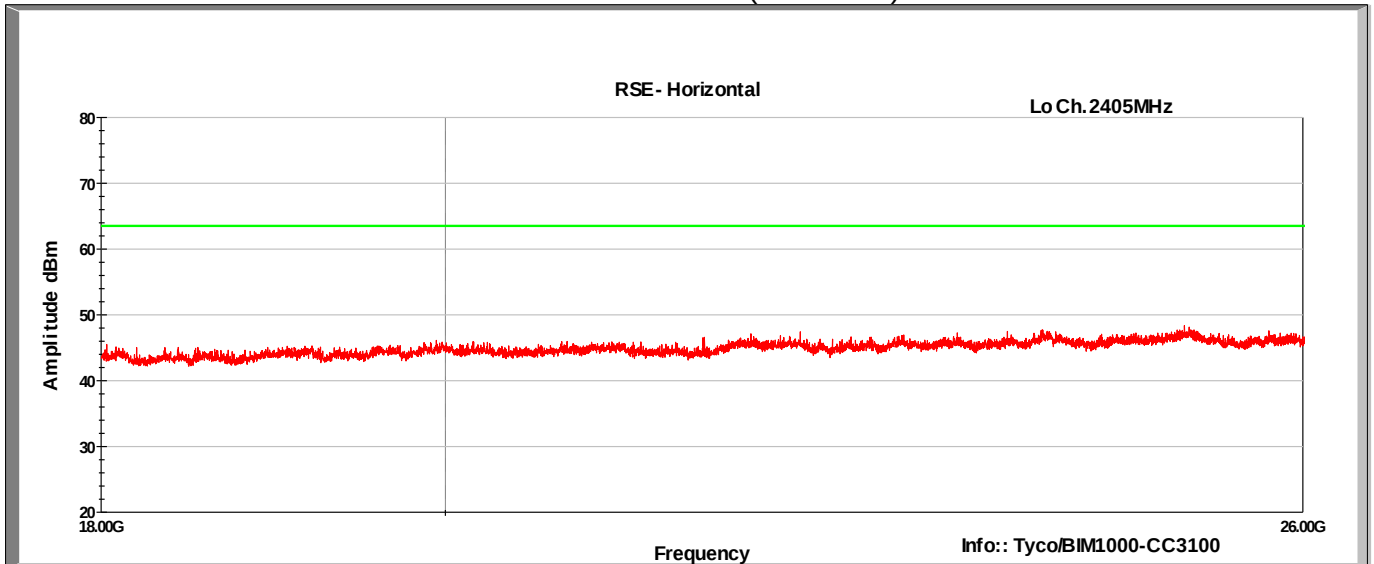
Low Channel (Channel 11, 2405MHz) Peak Plot Horizontal (3-18GHz)



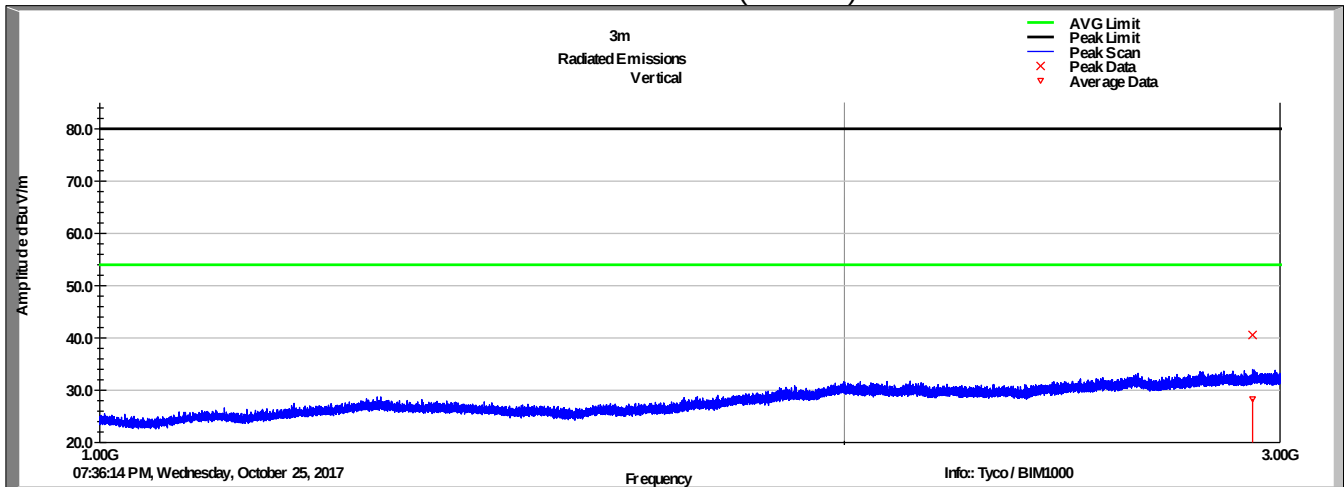
Low Channel
Peak Plot Vertical (18-26GHz)



Low Channel
Peak Plot Horizontal (18-26GHz)

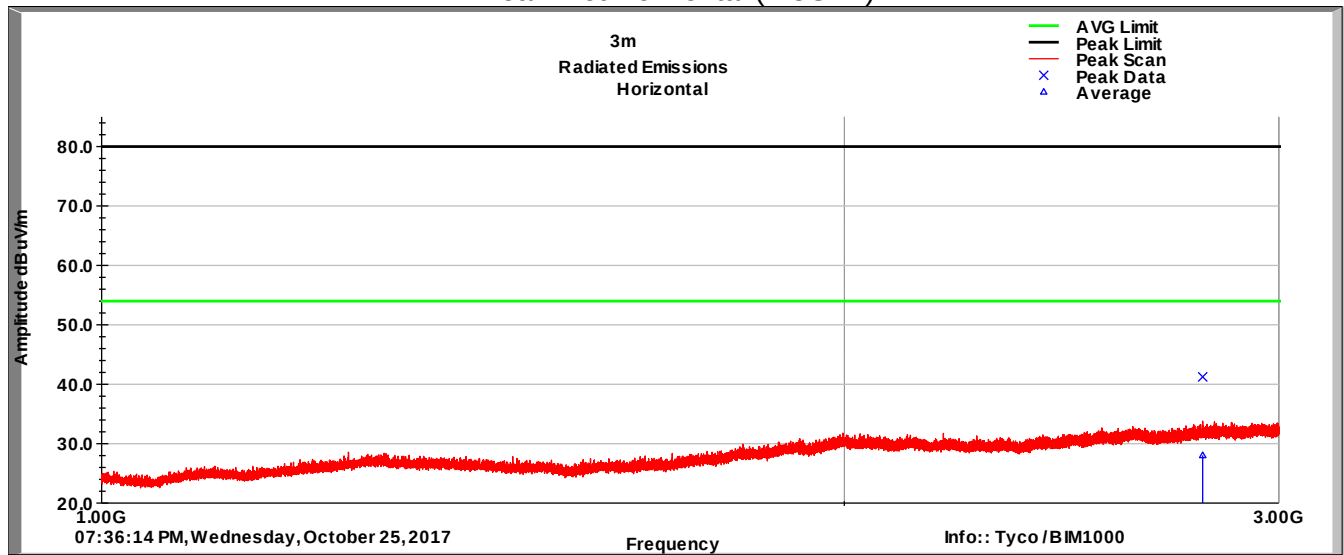


Mid Channel Peak Plot Vertical (1-3GHz)

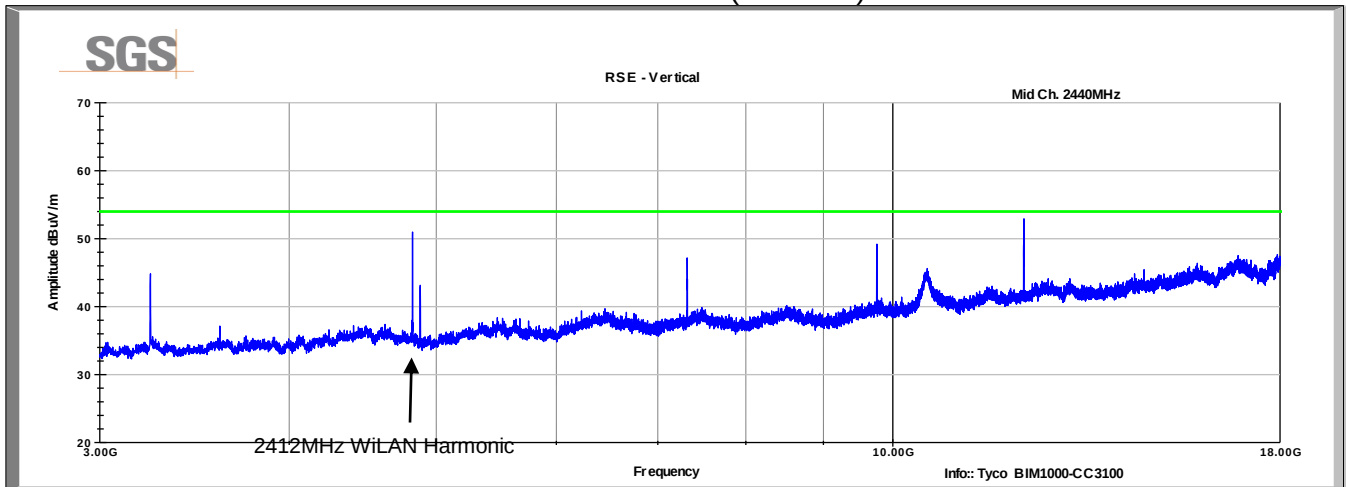


Note: 2.4GHz Band Reject filter in place

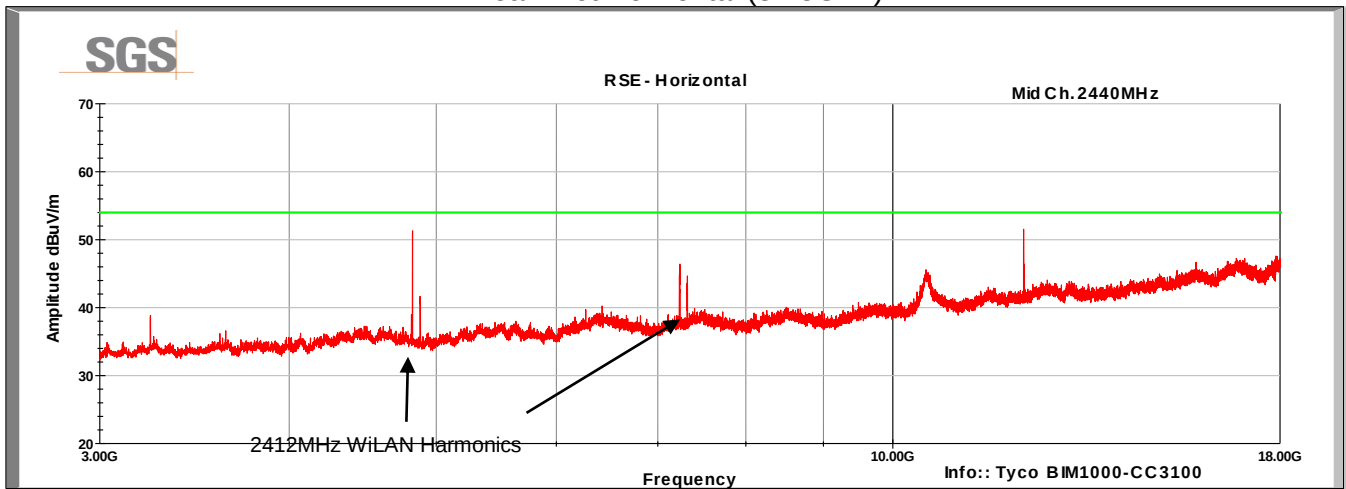
Mid Channel Peak Plot Horizontal (1-3GHz)



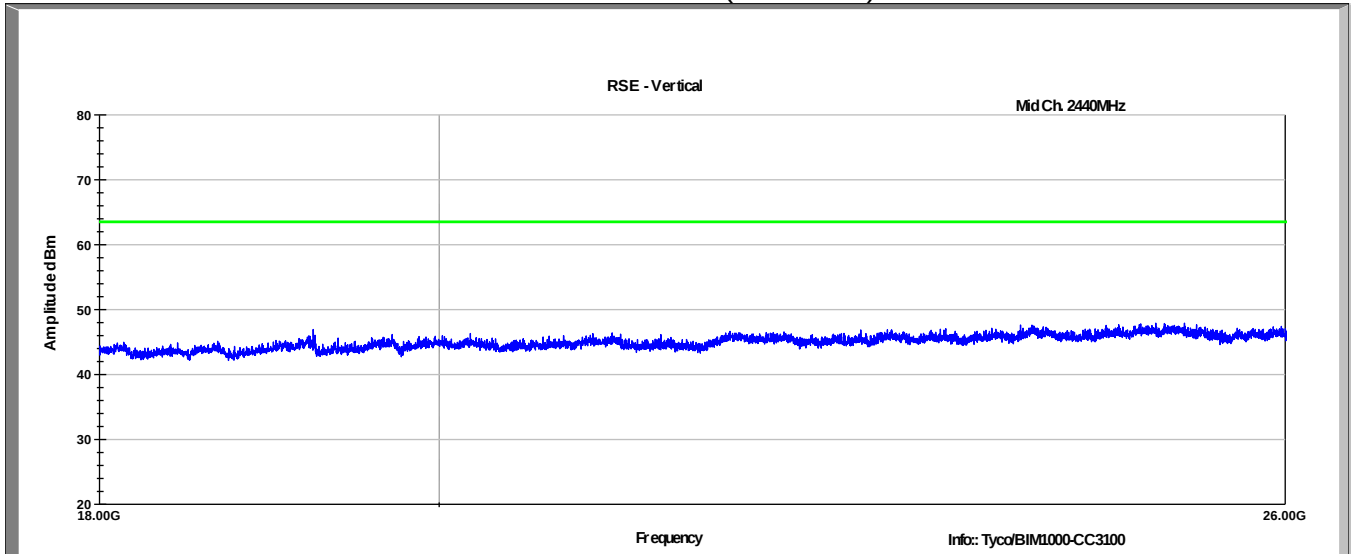
Mid Channel (Channel 18, 2440MHz) Peak Plot Vertical (3-18GHz)



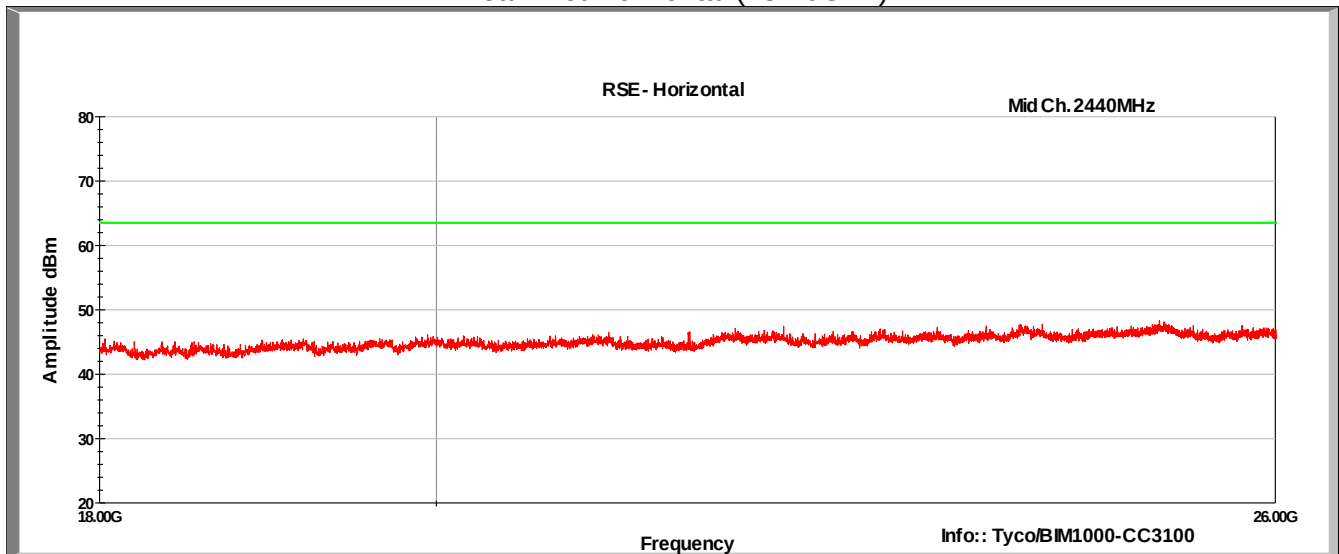
Mid Channel (Channel 18, 2440MHz) Peak Plot Horizontal (3-18GHz)



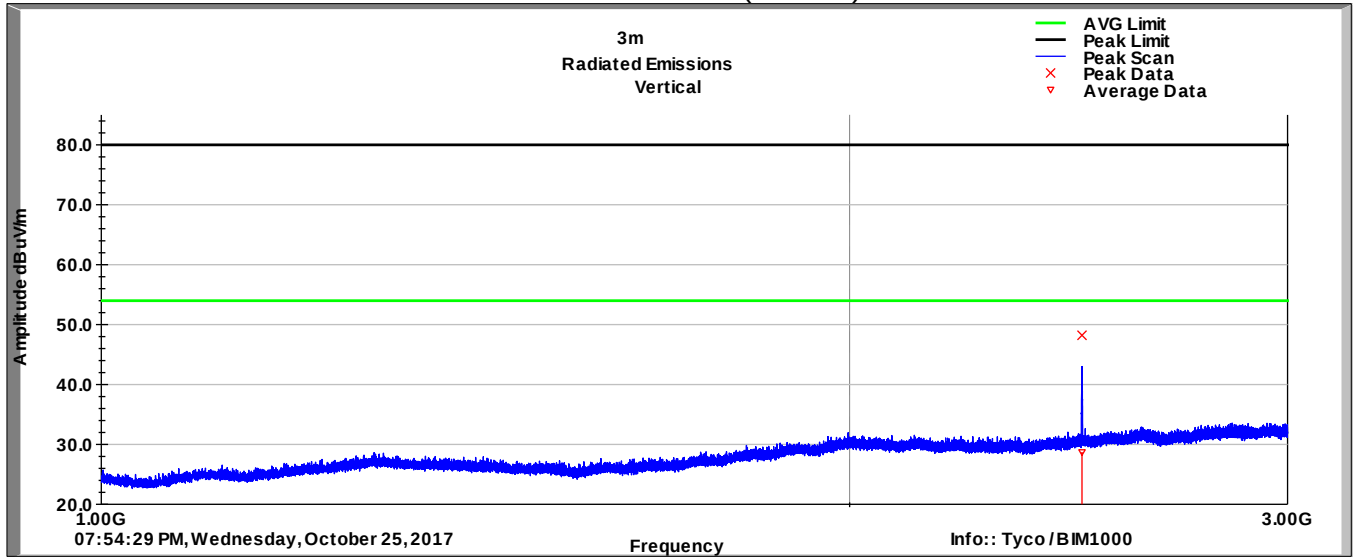
Mid Channel
Peak Plot Vertical (18-26GHz)



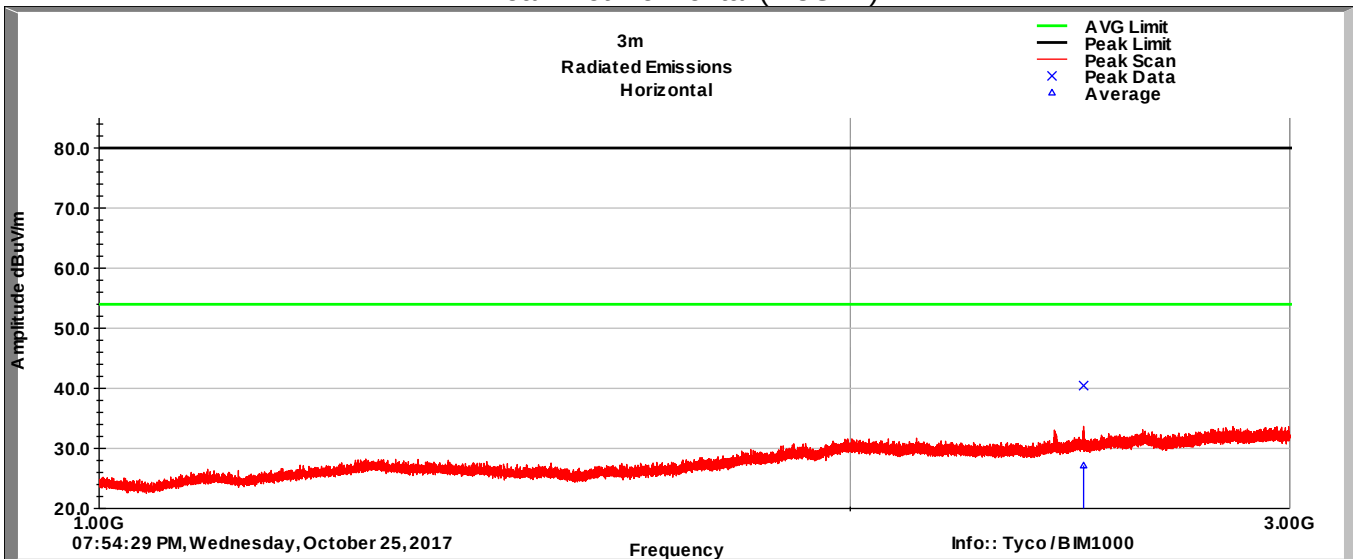
Mid Channel
Peak Plot Horizontal (18-26GHz)



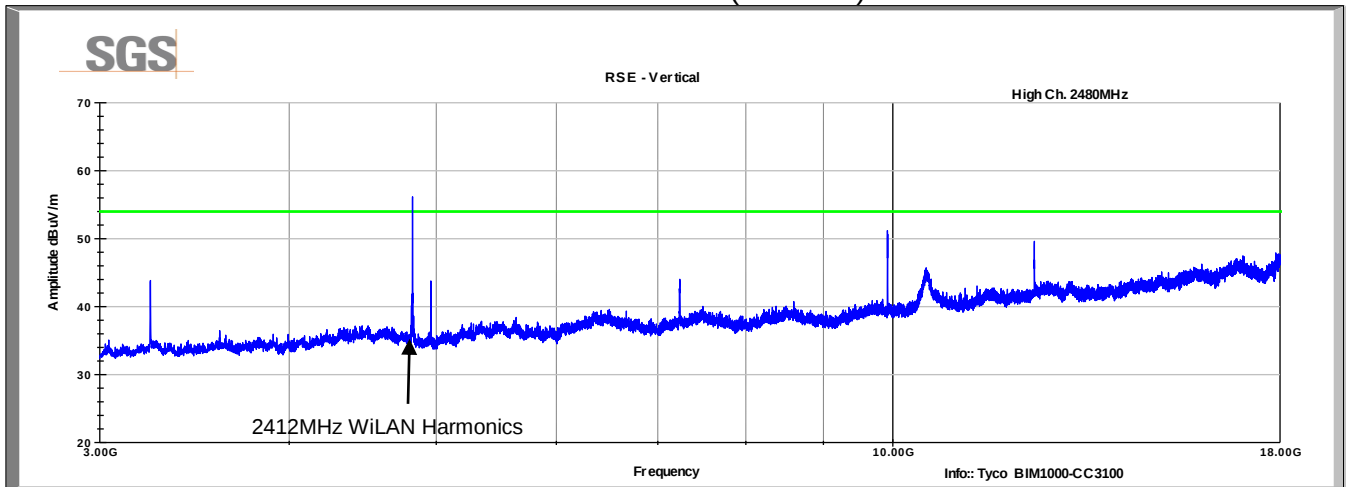
High Channel Peak Plot Vertical (1-3GHz)



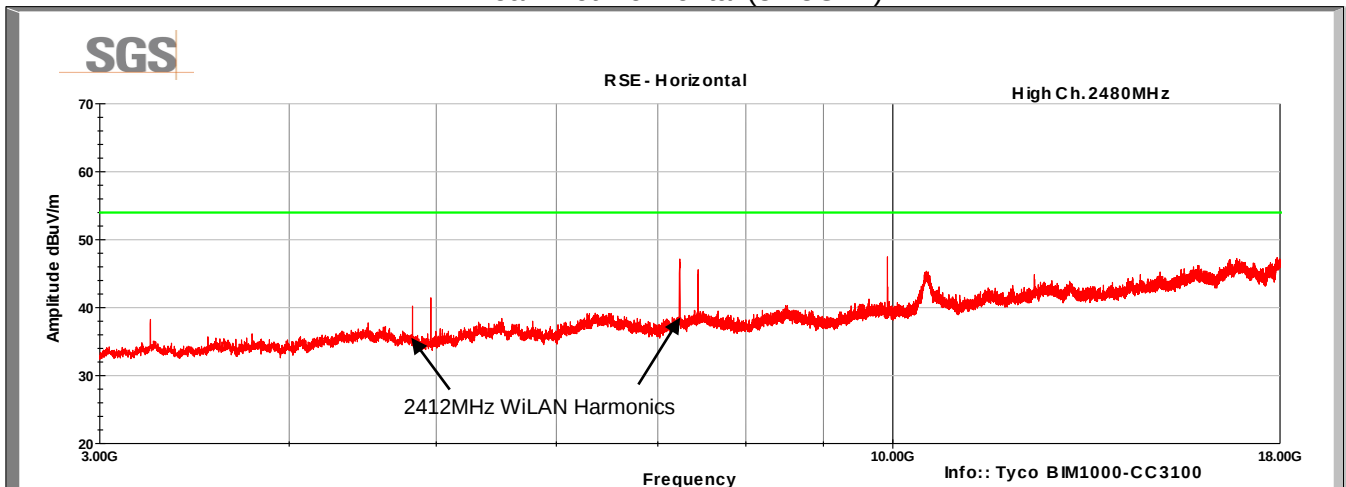
High Channel Peak Plot Horizontal (1-3GHz)



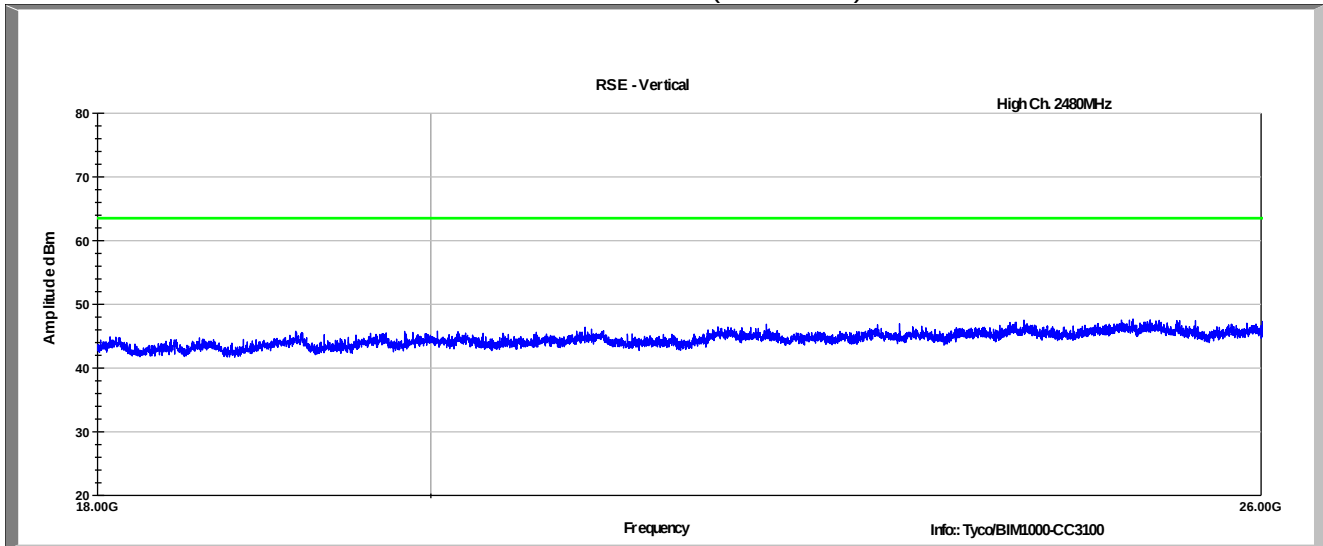
High Channel (Channel 25, 2475MHz) Peak Plot Vertical (3-18GHz)



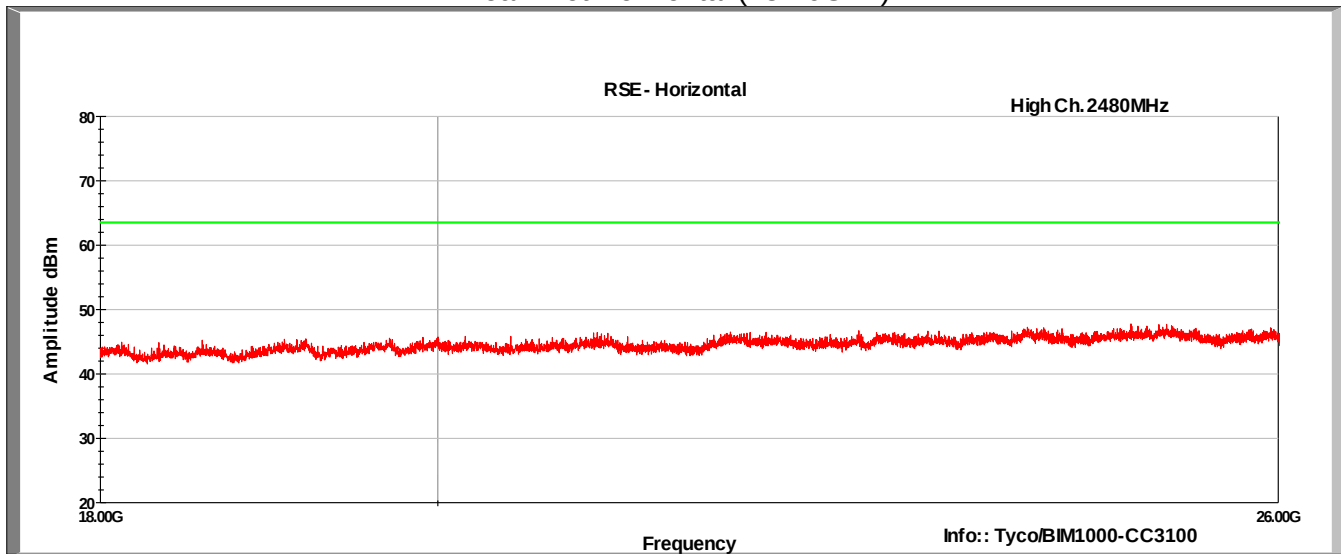
High Channel (Channel 25, 2475MHz) Peak Plot Horizontal (3-18GHz)



High Channel Peak Plot Vertical (18-26GHz)



High Channel Peak Plot Horizontal (18-26GHz)



7.6 Test Data – Tabular Data

Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QPValue (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.64	33.2	V	325.0	137.0	23.9	0.6	31.7	26.0	40.0	-14.0
36.26	38.6	V	7.0	119.0	20.9	0.7	32.0	28.2	40.0	-11.8
46.01	39.1	V	225.0	120.0	16.1	0.8	32.6	23.4	40.0	-16.6
55.28	47.1	V	109.0	241.0	12.5	0.9	32.9	27.6	40.0	-12.4
97.09	55.3	V	233.0	346.0	10.3	1.2	33.6	33.1	43.5	-10.4
106.63	49.5	V	51.0	157.0	12.1	1.2	33.7	29.1	43.5	-14.5
QPValue = Level + AF + CL - Amp										
Margin = QPValue - Limit										
Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QPValue (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.10	29.5	H	156.0	249.0	24.2	0.6	31.7	22.6	40.0	-17.4
97.12	51.2	H	260.0	335.0	10.3	1.2	33.6	29.1	43.5	-14.4
98.39	42.5	H	83.0	363.0	10.6	1.2	33.6	20.7	43.5	-22.9
106.69	42.8	H	280.0	400.0	12.1	1.2	33.7	22.4	43.5	-21.1
151.61	42.7	H	83.0	373.0	12.4	1.5	33.6	22.9	43.5	-20.6
875.09	33.7	H	134.0	178.0	21.4	3.6	33.2	25.4	46.0	-20.6
QPValue = Level + AF + CL - Amp										
Margin = QPValue - Limit										

Note: There was no change in the emission profile below 1GHz when switching among Channels 11, 18, and 25.

Frequency MHz	Raw Meas (dBuV)	Polarity (V/H)	Correction (dB/m)	Corr Value dBuV/m	Limit (dBuV/m)	Margin (dB)	Detector
Channel 11 (2405MHz)							
4810.00	44.7	V	3.9	48.6	54.0	-5.4	Peak
12025.00	38.0	V	10.7	48.7	54.0	-5.3	Peak
4810.00	46.6	H	3.9	50.5	54.0	-3.5	Peak
12025.00	39.5	H	10.7	50.2	54.0	-3.8	Peak
Channel 18 (2440MHz)							
4880.00	39.3	V	3.8	43.1	54.0	-10.9	Peak
7320.00	41.3	V	5.9	47.2	54.0	-6.8	Peak
9760.00	40.9	V	8.3	49.2	NA	NA	Peak
12200.00	42.1	V	10.8	52.9	54.0	-1.1	Peak
4880.00	37.8	V	3.8	41.6	54.0	-12.4	Peak
7320.00	38.7	V	5.9	44.6	54.0	-9.4	Peak
12200.00	39.7	V	10.8	50.5	54.0	-3.5	Peak
Channel 25 (2475MHz)							
4950.00	40.0	V	3.8	43.8	54.0	-10.2	Peak
7425.00	37.9	V	6.1	44.0	54.0	-10.0	Peak
9900.00	42.6	H	8.6	51.2	NA	NA	Peak
12375.00	38.8	H	10.8	49.6	54.0	-4.4	Peak
4950.00	37.6	V	3.8	41.4	54.0	-12.6	Peak
7425.00	39.5	V	6.1	45.6	NA	NA	Peak
9900.00	38.7	H	8.6	47.3	54.0	-6.7	Peak

* These emissions did not fall into restricted bands.

Note: Peak data compared to average limits.

8 Radiated Emissions at Band Edge / Restricted Band

8.1 Test Result

Test Description	Test Specification		Test Result
Spurious Emissions	15.205 / 15.209	RSS-GEN S8.9 / 8.10	Compliant

8.2 Test Method

Peak and average field strength measurements were performed at the restricted band edges of 2390MHz and 2483.5MHz. Measurements were made using the conducted methods defined in FCC KDB publication 558074 D01 DTS Meas Guidance v04.

8.3 Test Site

3m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

Environmental Conditions

Temperature: 23.2 °C

Relative Humidity: 51.5 %

8.4 Test Equipment

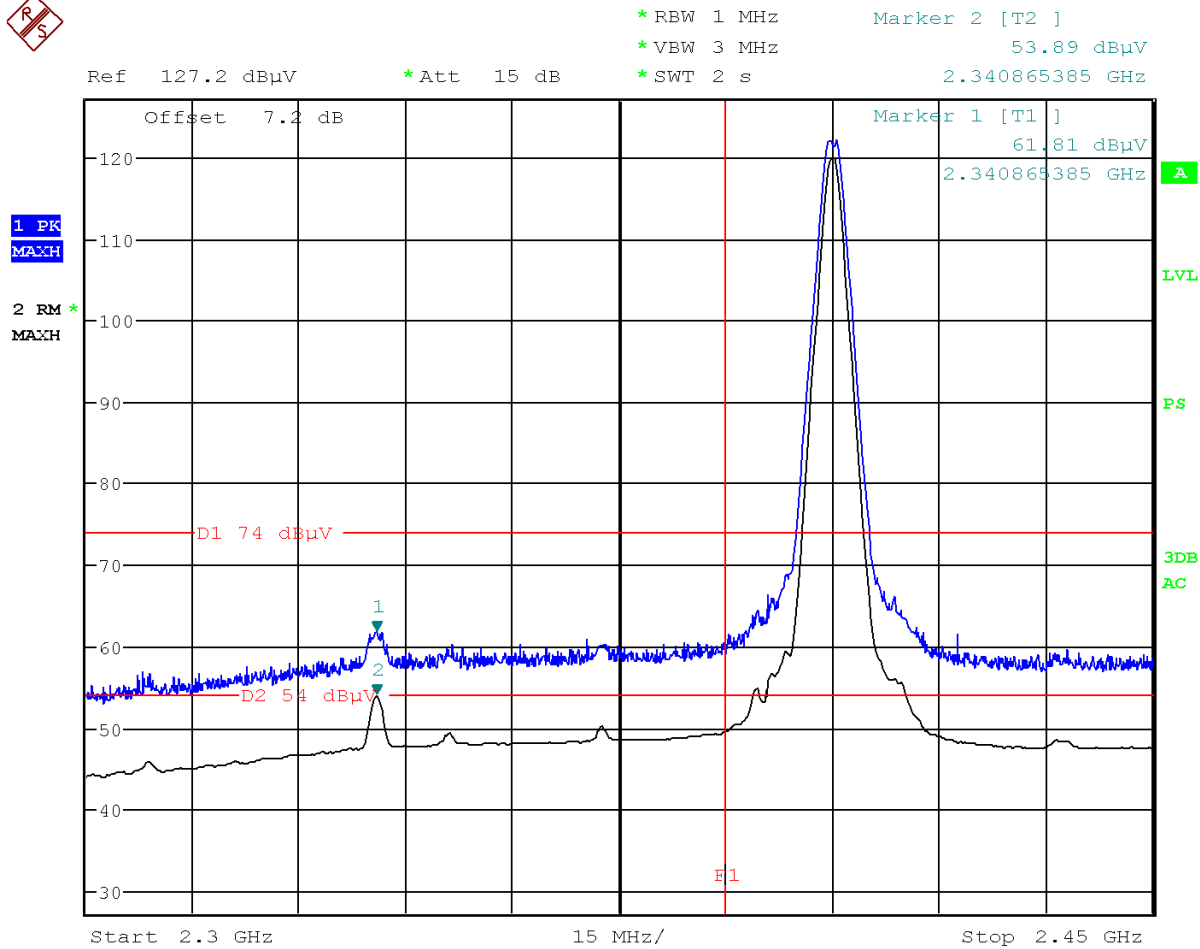
Test End Date: 26-Oct-2017

Tester: SKM

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Signal Analyzer	FSV-30	Rohde & Schwarz	Rental	28-Sep-2018
RF CABLE	SF102	HUBER & SUHNER	B079823	26-Jul-2018

Note: The equipment calibration period is 1 year except for the FSV which is on a 2-year calibration cycle.

Test Data

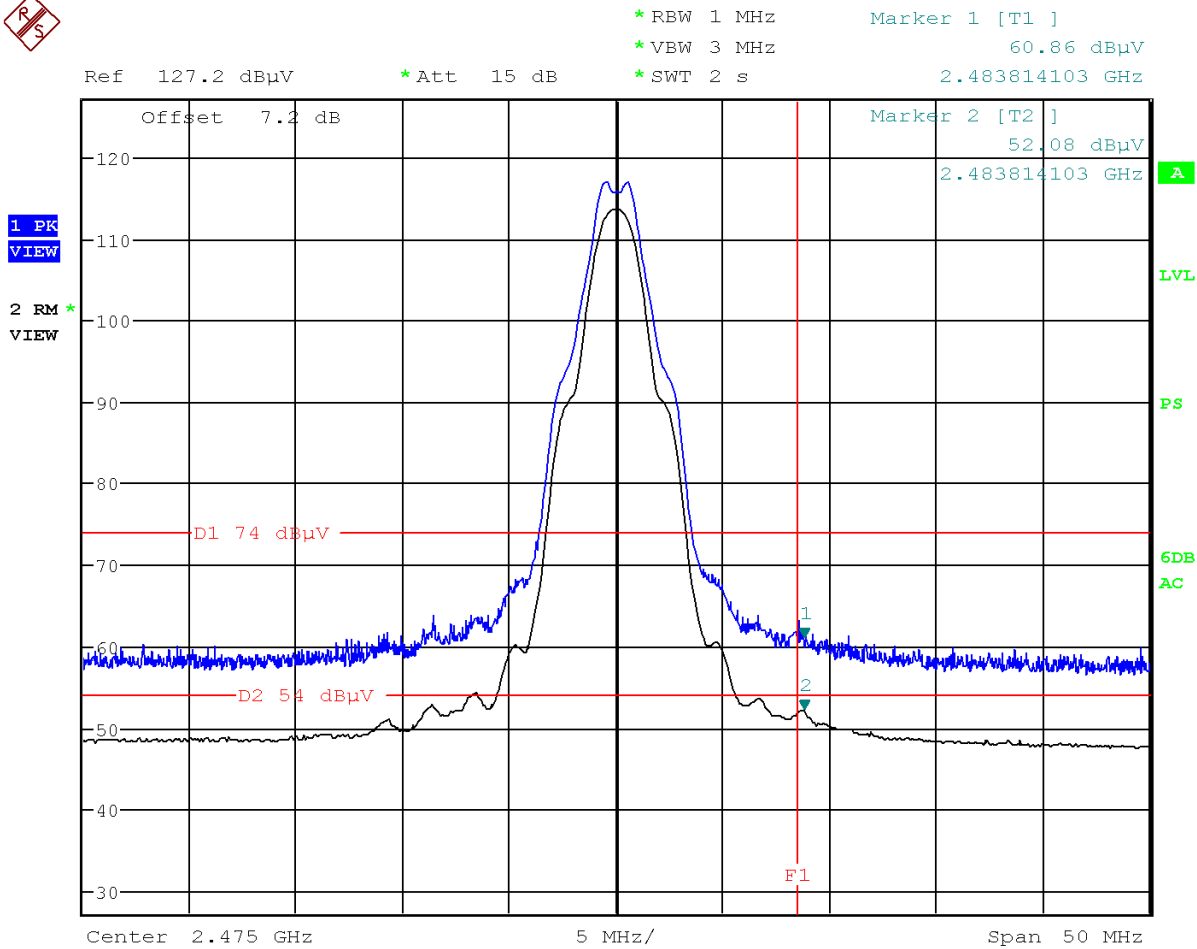


Date: 31.OCT.2017 13:30:47

Channel 11

Channel	Frequency (MHz)	Reading (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Measuremnt Detector
11	2340.8	61.81	74	-12.19	Peak
11	2340.8	53.89	54	-0.11	RMS

Channel 25 (2475@16dBm)



Date: 31.OCT.2017 13:45:51

Channel	Frequency (MHz)	Reading (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Measuremnt Detector
25	2483.8	60.86	74	-13.14	Peak
25	2483.8	52.08	54	-1.92	RMS

9 Conducted Emissions

9.1 Test Result

Test Description	Basic Standards	Test Result
Conducted Emissions, Class B	RSS-GEN, Issue 4 ANSI C63.4:2014	Compliant

9.2 Test Method

With the receiver's resolution bandwidth was set to 9 kHz the initial preliminary exploratory scans were performed over the measuring frequency range (0.15MHz to 30MHz) using a max hold mode incorporating a Peak detector and Average detector and using the TILE! software. The final test data was measured using a Quasi-Peak detector and Average detector and compared against the limits indicated in the table below.

Frequency Range	Class A Limits (dBuV)	Class B Limits (dBuV) CISPR
0.15 to 0.5 MHz	Avg 66 QP 79	Avg 56 to 46 QP 66 to 56
0.5 to 5 MHz	Avg 60 QP 73	Avg 46 Pk 56
5 to 30 MHz	Avg 60 QP 73	Avg 50 Pk 60

9.3 Test Equipment

Test End Date: 30-Oct-2013

Tester: SKM

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	25-Apr-2018
LINE IMPEDANCE STABILIZATION NETWORK	NNB 51	TESEQ	B087573	16-Nov-2017
CONDUCTED COMB GENERATOR	CGC-255	COM-POWER	B079696	CNR
RF CABLE	SF106	HUBER & SUHNER	B079659	25-Jul-2018

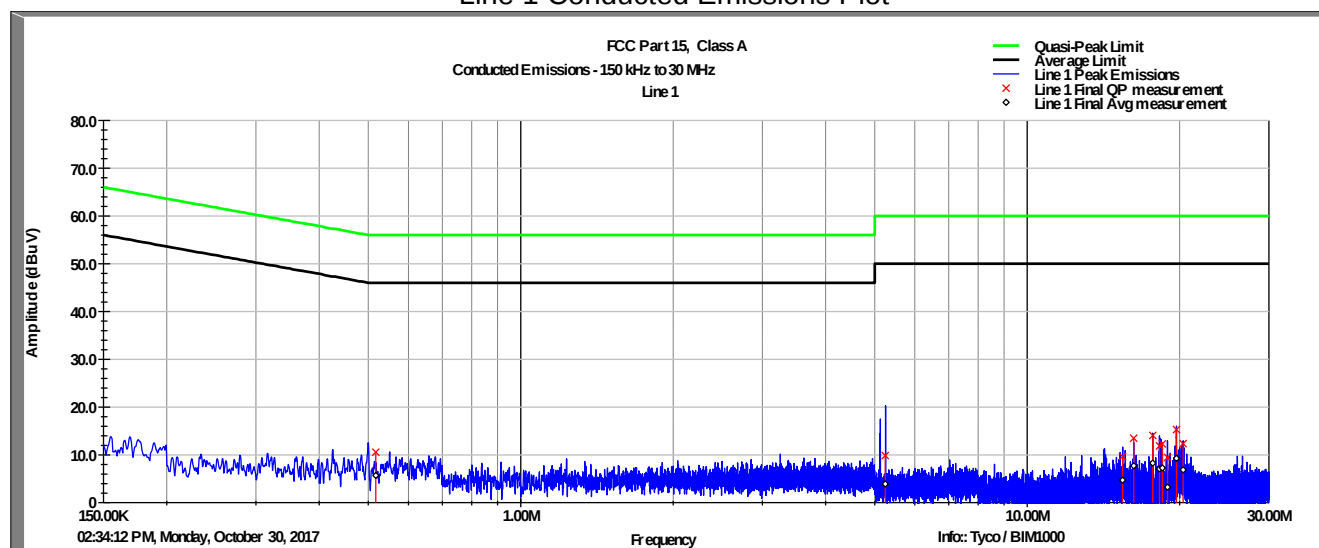
Note: The equipment calibration period is 1 year.

Software:

TILE! software profile: Conducted Emissions_2015.TIL

9.4 Test Data

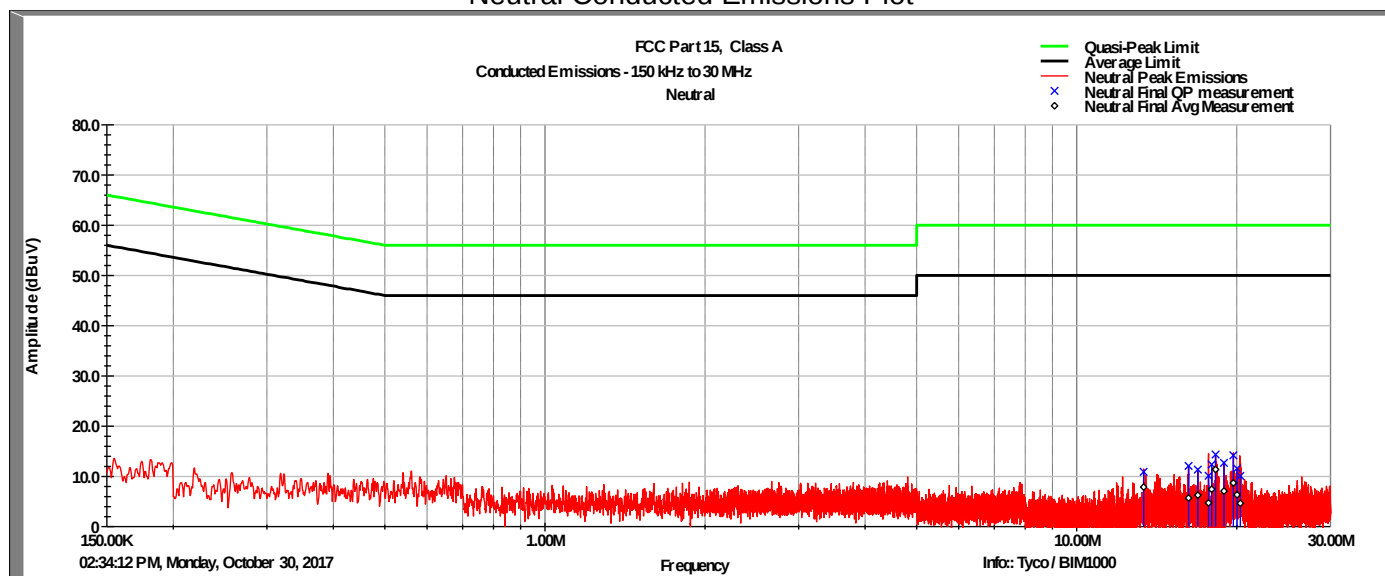
Line 1 Conducted Emissions Plot



Line 1 Conducted Emissions Data

Frequency MHz	QP Value dBuV	QP Limit dBuV	QP Margin dB	Avg Value dBuV	Avg Limit dBuV	Avg Margin dB
0.518	10.5	56.0	-45.5	5.7	46.0	-40.3
5.244	9.8	60.0	-50.2	3.9	50.0	-46.1
15.431	9.6	60.0	-50.4	4.7	50.0	-45.3
16.230	13.5	60.0	-46.5	7.7	50.0	-42.3
17.695	14.1	60.0	-45.9	8.3	50.0	-41.7
18.249	11.9	60.0	-48.1	7.1	50.0	-42.9
18.488	12.3	60.0	-47.7	7.3	50.0	-42.7
18.930	9.5	60.0	-50.5	3.2	50.0	-46.8
19.710	15.3	60.0	-44.7	9.3	50.0	-40.7
20.321	12.3	60.0	-47.7	6.9	50.0	-43.1

Neutral Conducted Emissions Plot



Neutral Conducted Emissions Data

Frequency MHz	QP Value dBuV	QP Limit dBuV	QP Margin dB	Avg Value dBuV	Avg Limit dBuV	Avg Margin dB
13.359	10.9	60.0	-49.1	7.9	50.0	-42.1
16.232	12.1	60.0	-47.9	5.7	50.0	-44.3
16.900	11.3	60.0	-48.7	6.2	50.0	-43.8
17.700	10.1	60.0	-49.9	4.7	50.0	-45.3
17.940	12.4	60.0	-47.6	7.4	50.0	-42.6
18.246	14.4	60.0	-45.6	11.4	50.0	-38.6
18.915	12.7	60.0	-47.3	7.1	50.0	-42.9
19.709	14.2	60.0	-45.8	8.7	50.0	-41.3
20.018	11.6	60.0	-48.4	6.3	50.0	-43.7
20.309	10.1	60.0	-49.9	4.6	50.0	-45.4

10 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	12 February 2018