ELECTRONICS TEST CENTRE
MPB TECHNOLOGIES INC.

ACCREDITED
TESTING CERT#2750.01

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ETC Report #: l22e18a312 FCC GSG Rel.2 Report date: February 15, 2019

Test Dates: December 11,13,14, 18 ,19 of 2018

EMC testing of the Levven Automation Soulplay FHSS wireless radio in accordance with

FCC Part 15.247, ANSI C63.4: 2014 and ANSI C63.10: 2013 as referenced by FCC DA-00-705 rel. March 30, 2000.

FCC ID: 2AA9N-LASY40

Prepared for: Levven Automation

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REVISION RECORD

ISSUE	DATE	AUTHOR	REVISIONS
DRAFT 1	2019-01-14	I. Akram	Initial draft submitted for review.
Release 1	2019-02-11	M. Rousseau	Sign off
Release 2	2019-02-15	I. Akram	Combined measurement data in one report and correction in calibration dates, band edge plot heading correction and frequencies.

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1.0 INTRODUCTION

1.1 Scope

The purpose of this report is to present the results of compliance testing performed in accordance with FCC Part 15.247, ANSI C63.4-2014 and ANSI C63.10-2013 to gain FCC Certification Authorization for Low-Power License-Exempt transmitters. All test procedures, limits, criteria, and results described in this report apply only to the Levven Automation Soulplay test sample, referred to herein as the EUT (Equipment Under Test).

The sample has been provided by the customer.

This report does not imply product endorsement by the Electronics Test Centre, A2LA, nor any Canadian Government agency.

1.2 Applicant

This test report has been prepared for Levven Automation, located in Edmonton, Alberta, Canada.

1.3 Test Sample Description

Product Name:	Soulplay
Frequency Band	2400 – 2483.5 MHz
EUT Classification	FHSS
Type of Modulation	FSK (Frequency Shift Keying)
Frequency Range	2403.5 – 2477.3 MHz
Antenna Ginseng 1 radio	In-frame, dipole, 5.77 dBi
Antenna Ginseng 2 radio	PCB trace, Slot Antenna, 4.20dBi
Detachable/Non Detachable	Non-detachable
Model# / Serial#	LA-SY40 (with enclosure), s/n N/A LA-SY40 (PCBA), s/n N/A
Power supply:	120 VAC / 60 Hz

As provided to ETC (Airdrie) by Levven Automation:

1.4 General Test Conditions and Assumptions

The EUT was set up and exercised using the configurations, modes of operation and arrangements defined in this report only. All inputs and outputs to and from other equipment associated with the EUT were adequately simulated.

Test software provided by the customer was used to program the EUT to transmit continuously. The device operates in FSK modulation and all modes were tested and included in this report. Channel numbers 0, 48 were used as Low, Mid and High Channels respectively.
The channels used for the test are:
Low = channel 1 (2403.5 MHz)
MID = channel 25 (2440.4 MHz)
High. = channel 49 (2477.3 MHz)
The environmental conditions are recorded during each test and are reported in the relevant sections of this document.

1.5 Scope of Testing

Tests were performed in accordance with FCC Part 15.247, ANSI C63.4: 2014, ANSI C63.10: 2013 as referenced in FCC DA 00 705 rel. March 30, 2000.

1.5.1 Test Methodology

Test methods are specified in the Basic Standard as referenced and/or modified by the Product Standard in the part of Section 2 of this report associated with each particular test case.

1.5.2 Variations in Test Methodology

Any variance in methodology or deviation from the reference Standard is documented in the part of Section 2 of this report associated with each particular Test Case.

1.5.3 Test Sample Verification, Configuration & Modifications

EUT setup, configuration, protocols for operation and monitoring of EUT functions, and any modifications performed in order to meet the requirements, are detailed in each Test Case of Section 2 of this report.

1.5.4 Uncertainty of Measurement:

The factors contributing to uncertainty of measurement are identified and calculated in accordance with UKAS (United Kingdom Accreditation Service) document “Lab 34, The Expression of Uncertainty in EMC Testing, Aug 2002.” as based on the “ISO Guide to the Expression of Uncertainty in Measurement, 1995.”

This uncertainty estimate represents an expended uncertainty expressed at approximately 95% confidence using a coverage factor of k = 2.

Test Method	Uncertainty
Radiated Emissions Level (9 KHz – 1 GHz)	±4.6 dB
Radiated Emissions Level (1 GHz – 26.5 GHz)	±5.31 dB
Conducted Emissions Level (150 KHz – 30 MHz)	±2.7 dB
Uncertainty Conducted Power level	±0.5 dB
Uncertainty Conducted Spurious emission level	±0.6 dB
Uncertainty for Bandwidth test	±1.5 %

2.0 TEST CONCLUSION

STATEMENT OF COMPLIANCE

The customer equipment referred to in this report was found to comply with the requirements, as summarized below.

The EUT was subjected to the following tests. Compliance status is reported as **Compliant** or **Non-compliant**. **N/A** indicates the test was Not Applicable to the EUT.

Note: Maintenance of compliance is the responsibility of the Manufacturer. Any modifications to the product should be assessed to determine their potential impact on the compliance status of the EUT with respect to the standards detailed in this test report.

The following table summarizes the tests performed in terms of the specification, class or performance criterion applied, and the EUT modification state.

Test Case	Test Type	Specification	Test Sample	Modifications	Config.	Result
Ginseng1 Frequency Range = 2403.5 – 2477.3 –MHz Max. Conducted Tx Power=15.716dBm (37.3mW)			**Ginseng2 Frequency Range = 2403.5 – 2477.3 –MHz Max. Conducted Tx Power=15.463dBm (35.2mW)**			
2.1	AC Conducted Emissions (Tx)	15.207	LA-SY40 (PCBA)	none	see § 2.1	**Compliant**
2.2	Occupied Bandwidth	15.247(a)(1) 15.247(2)(2)	LA-SY40 (PCBA)	none	see § 2.2	**Compliant**
2.3	Max Output Power Conducted	15.247(b)	LA-SY40 (PCBA)	none	see § 2.3	**Compliant**
2.4	Band Edge	15.247(d)	LA-SY40 (PCBA)	none	see § 2.4	**Compliant**
2.5	Conducted Spurious	15.247(d)	LA-SY40 (PCBA)	none	see § 2.5	**Compliant**
2.6	Minimum channel separation	15.247(a)(1)	LA-SY40 (PCBA)	none	see § 2.6	**Compliant**
2.7	Hopping Channels	15.247(a, 1(iii))	LA-SY40 (PCBA)	none	see § 2.7	**Compliant**
2.8	Average time of Occupancy	15.247(a, 1(iii))	LA-SY40 (PCBA)	none	see § 2.8	**Compliant**
2.9	EUT Position	ANSI C63.4	LA-SY40 (with enclosure)	none	see § 2.9	**n/a**
2.10	Radiated Spurious (Tx Mode)	15.205, 15.209 15.247(d)	LA-SY40 (with enclosure)	none	see § 2.11	**Compliant**
2.11	RF Exposure	15.247(i)	LA-SY40 (PCBA)	none	see § 2.10	**Exempt**

Refer to the test data for applicable test conditions.

2.1 AC Power Line Conducted Emissions: Transmit Mode

Test Lab: Electronics Test Centre, Airdrie	**EUT: Soulplay**
Test Personnel: Bushra Muharram	**Standard: FCC Part 15.207**
Date: 2018-12-19 (21.3°C,14.3 % RH)	**Basic Standard: ANSI C63.10: 2013**
EUT status: Compliant	
Comments The conducted emissions produced by a device shall not exceed the limits as specified.	

2.1.1 Test Guidance: ANSI C63.10-2013, Clause 6.2

Before any testing is performed, the Ambient (measurement noise floor) is recorded, and a QC check is performed to show that the system is functioning correctly.

Testing starts with a scan, performed under software control. After this is complete, the list of frequencies of interest is generated. These frequencies are then investigated for quasi-peak and average amplitude, as applicable. Emissions measured with a QP detector that fall below the Average limit are deemed to meet both requirements.

2.1.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

2.1.3 Test Equipment

Testing was performed with the following equipment:

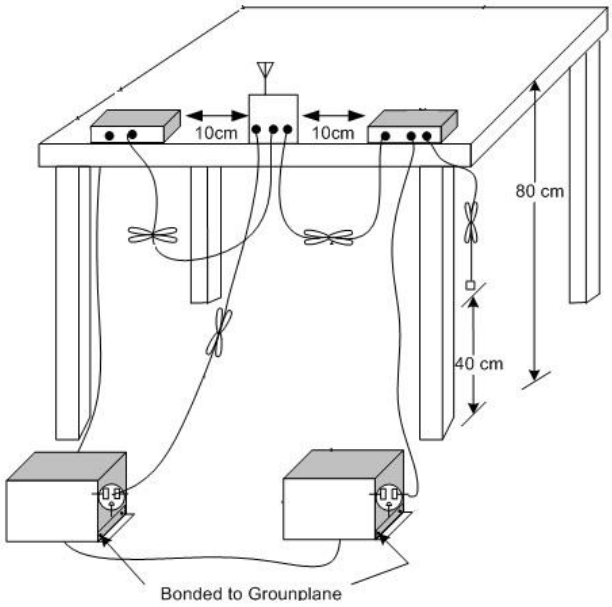
Equipment	Manufacturer	Model #	Asset #	Calibration Date	Calibration Due
EMC Software	UL	Ver. 9.5	ETC-SW-EMC 2.1	N/A	N/A
EMI receiver	Agilent	N9038A	6130	2018-05-02	2019-05-02
LISN	Com-Power	LI-215A	6180	2018-06-06	2020-06-06
Temp/RH logger	Extech	42270	5892	2018-04-13	2019-04-13

2.1.4 Test Sample Verification, Configuration & Modifications

The Soulplay was power up by main. Both radios are transmitting simultaneously in a worse case transmit power during the test.

The EUT met the requirements without modification.

Test setup diagram:



2.1.5 Conducted Emissions Data:

The EUT was evaluated in all transmit/Receive mode.

The emissions data is presented in tabular form, showing the uncorrected spectrum analyzer reading, the correction factors applied, the net result, the value(s) of limit at the frequency measured, and the Delta between the result and the limit.

Freq. Marker	Freq. (MHz)	Raw reading (dBµv)	Det.	LISN Factor (dB/m)	Cable Loss (dB)	Corrected Reading (dBµV)	FCC 15.207 Limit (dBµV)	Delta (dB)	L / N
1	0.15846	35.02	Av	.8	0	35.82	55.54	-19.72	Line
2	0.18571	33.68	Av	.6	.1	34.38	54.23	-19.85	Line
1	0.15876	31.05	Av	.7	0	31.75	55.53	-23.78	Neutral
2	0.68805	29.4	Av	0	0	29.4	46	-16.6	Neutral

Av = Average Detector

Raw Reading in dBµV + Antenna Factor in dB/m + Gain/Loss Factor in dB = Corrected Field Strength in dbµV/m.

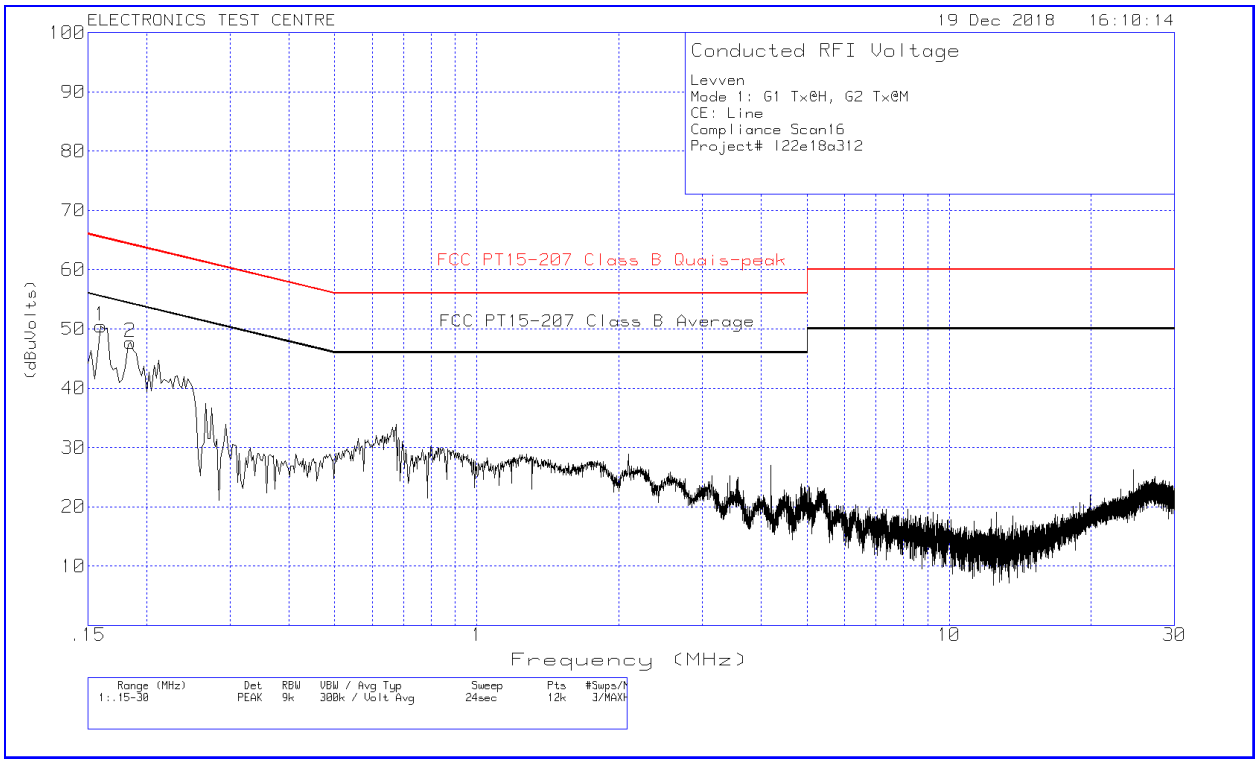
Note: When a preamp is used, the resulting gain is compensated, producing a negative value for the Cable Loss.

Negative values for Delta indicate compliance.

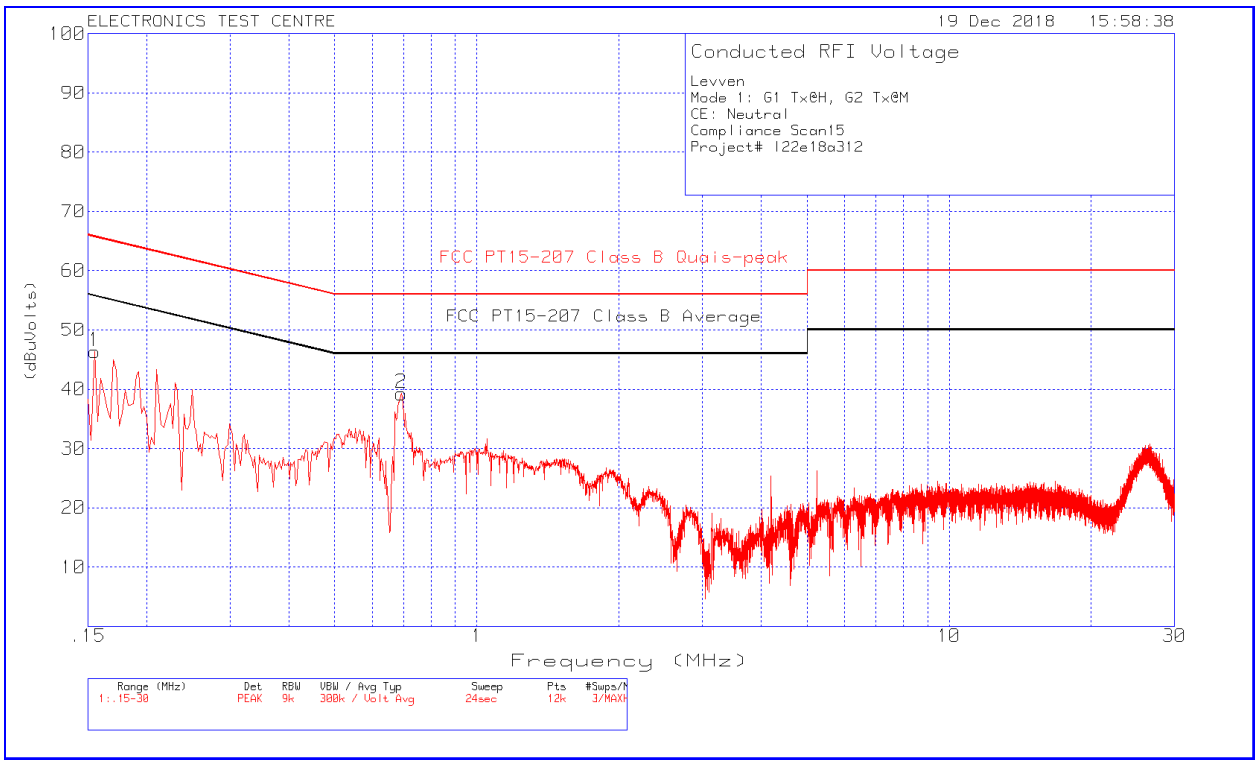
The Ground Bond was measured and found to be 1.1 mΩ.

Note: When a preamp is used, the resulting gain is compensated, producing a negative value for the Cable Loss.

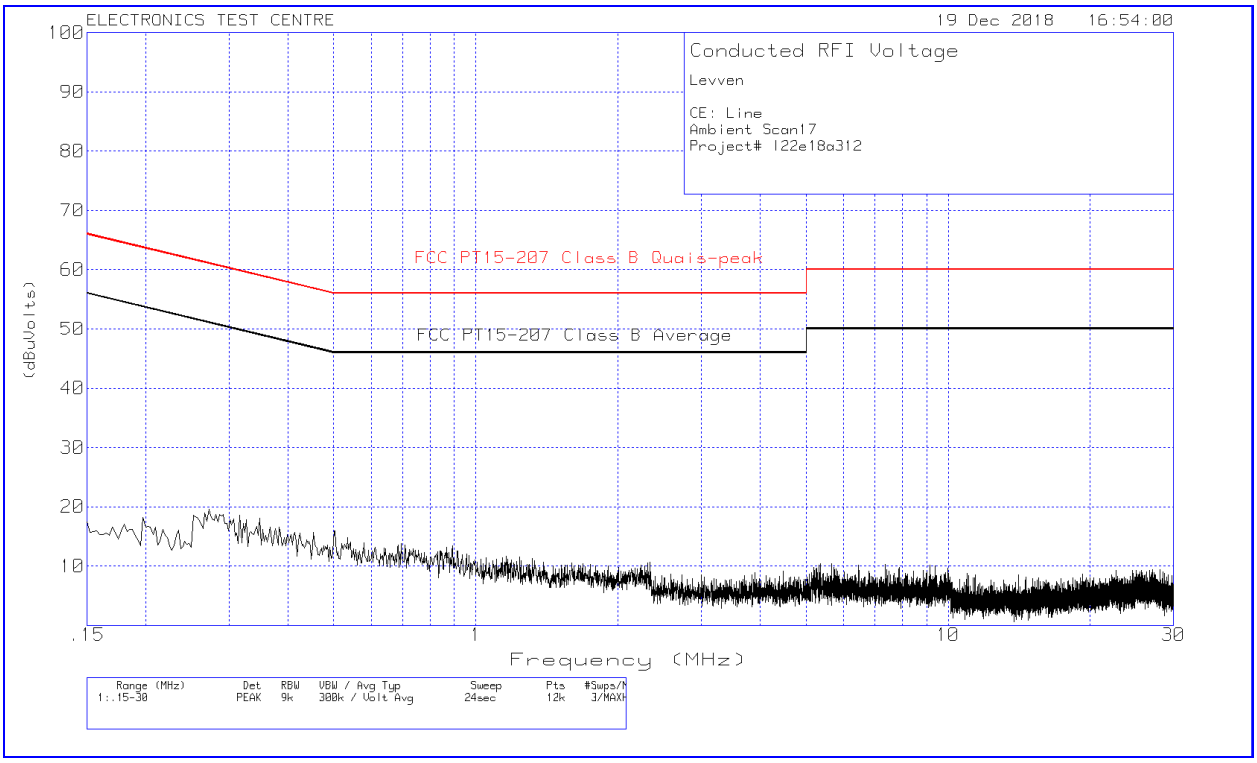
Plot of Conducted Emissions: Line (Tx Mode Ginseng1/Ginseng2)



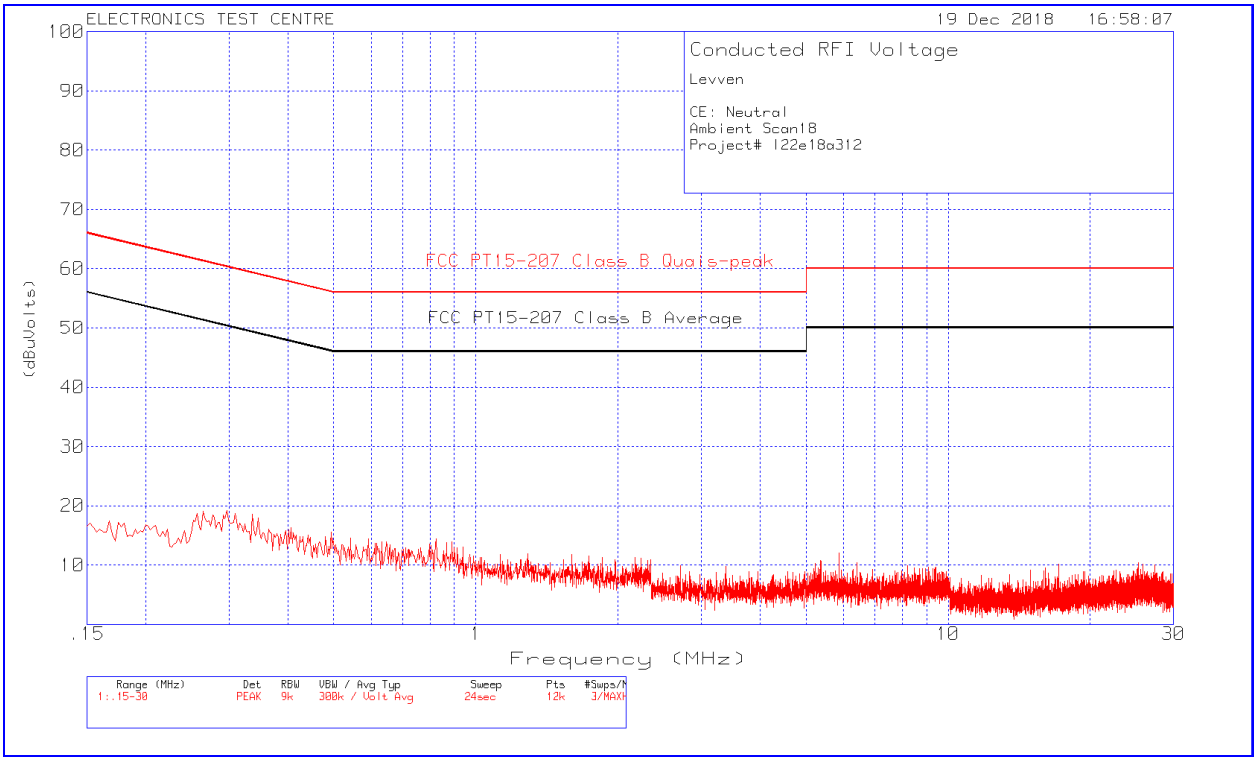
Plot of Conducted Emissions: Neutral (Tx Mode Ginseng1/Ginseng2)



Plot of Test Chamber Ambient: Line



Plot of Test Chamber Ambient: Neutral



2.2 Channel Occupied Bandwidth

Test Lab: Electronics Test Centre, Airdrie	**EUT: Soulplay**
Test Personnel: Imran Akram **Bushra Muharram**	**Standard: FCC PART 15.247** **Basic Standard: ANSI C63.10-2013**
Date: 2018-12-14 (20.6°C,14.2 % RH)	

EUT status: Compliant

Specification: FCC 15.247 (a, 1)

Criteria: 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. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

2.2.1 Test Guidance: ANSI C63.10-2013, Clause 6.9.2 & 6.9.3 / DA 00-705

This measurement is performed at low, mid and high frequencies, with modulation.

The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation. The loss from the cable and the attenuator were added on the analyzer as gain offset setting there by allowing direct measurements, without the need for any further corrections.

Use the following spectrum analyzer settings:	
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
Detector function	peak
Trace	max hold
Allow the trace to stabilize. The automated 99% BW function of the spectrum analyzer is engaged, 20 dB OBW is measured with the x dB function.	

2.2.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

2.2.3 Test Equipment

Testing was performed with the following equipment:

Equipment	Manufacturer	Model #	Asset #	Cal. Date	Interval	Cal. Due
EMI receiver	Agilent	N9038A	6130	2018-05-2	1 year	2019-05-2
Temp/Humidity	Extech	42270	5892	2018-04-13	1 year	2019-04-13
Attenuator	FairView Microwave	SA18N5WA-10	6886	2018-11-23	1 year	2019-11-23
DC Blocker	MCL	BLK-89-S+	-	2018-01-15	1 year	2019-01-15
CE Cable (50cm length)	Huber+Suhner	Enviroflex 400	-	2018-01-15	1 year	2019-01-15

2.2.4 Test Sample Verification, Configuration & Modifications

The EUT was set to transmit continuously on a selected channel with test-specific software. The output was modulated as in normal operation.

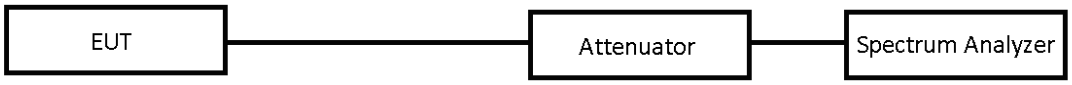
The EUT modified to provide the direct access to antenna trace for conducted measurements.

For compliance purposes EUT met requirements without any modification

There is no Deviation and exclusions from test specifications.

Test setup diagrams for Occupied Bandwidth testing:

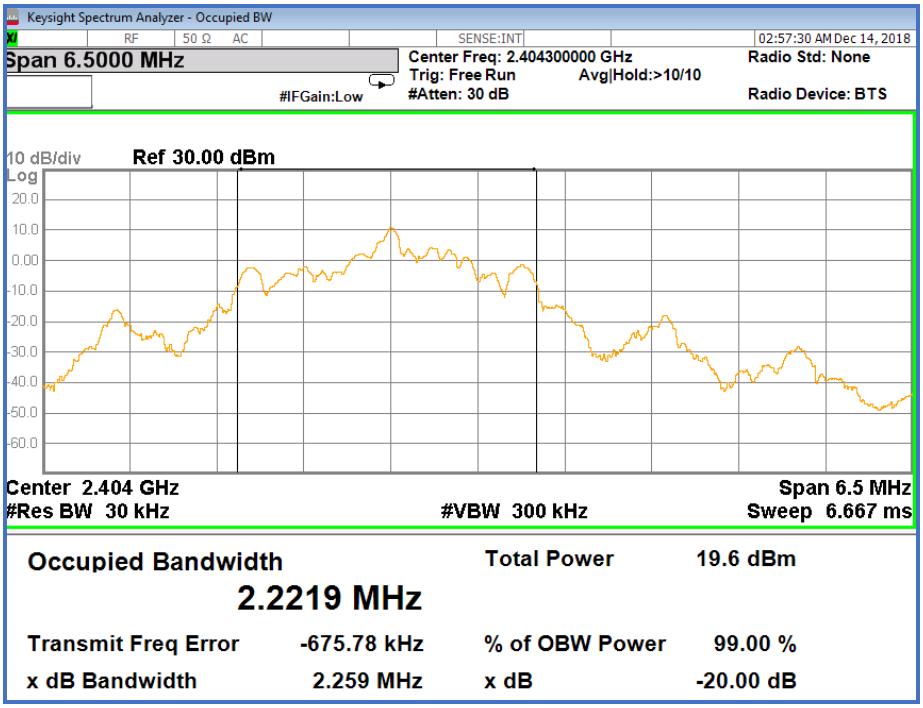
Conducted:



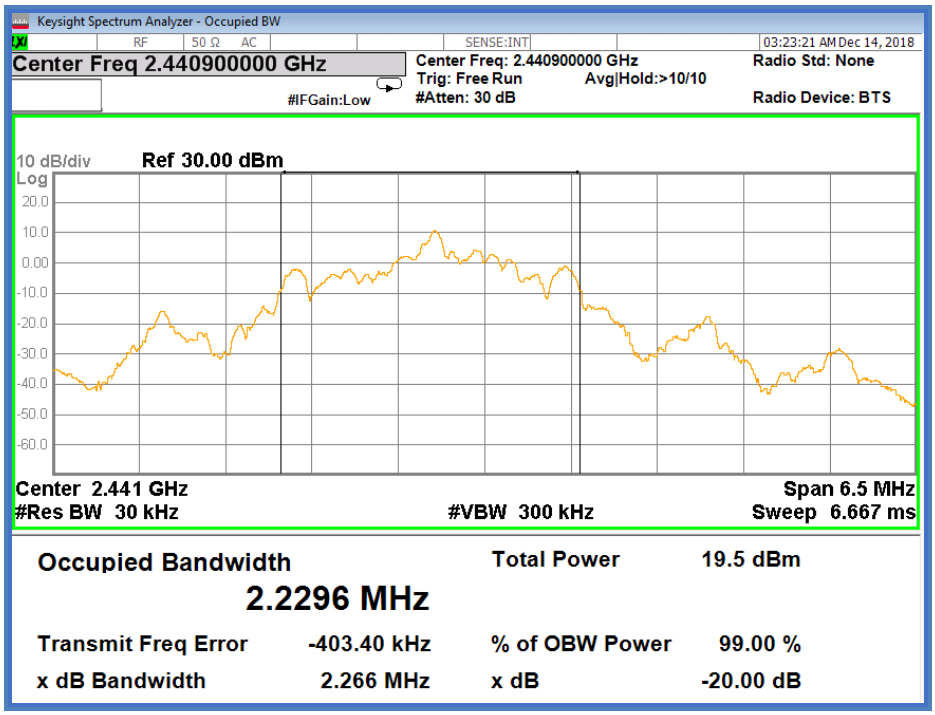
2.2.5 Channel Occupied Bandwidth Data: (Ginseng-1 Radio)

Channel	Freq. [MHz]	20 dB OBW [MHz]	99% OBW [MHz]
Low	2403.5	2.259	2.2219
Mid	2440.4	2.266	2.2296
High	2477.3	2.265	2.2799

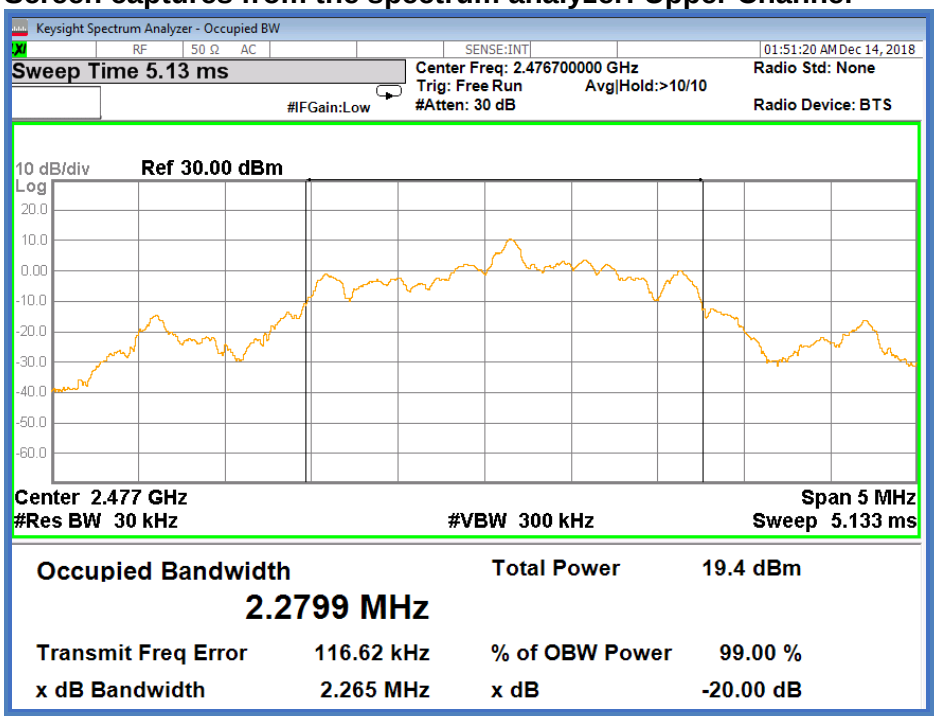
Screen captures from the spectrum analyzer: Low Channel



Screen captures from the spectrum analyzer: MID Channel



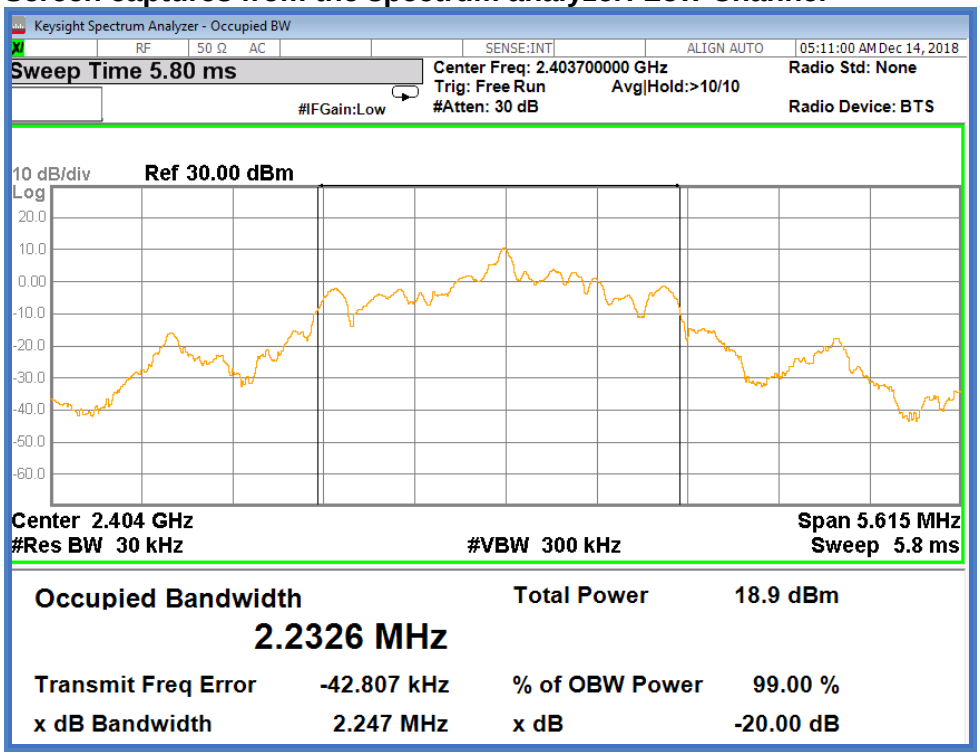
Screen captures from the spectrum analyzer: Upper Channel



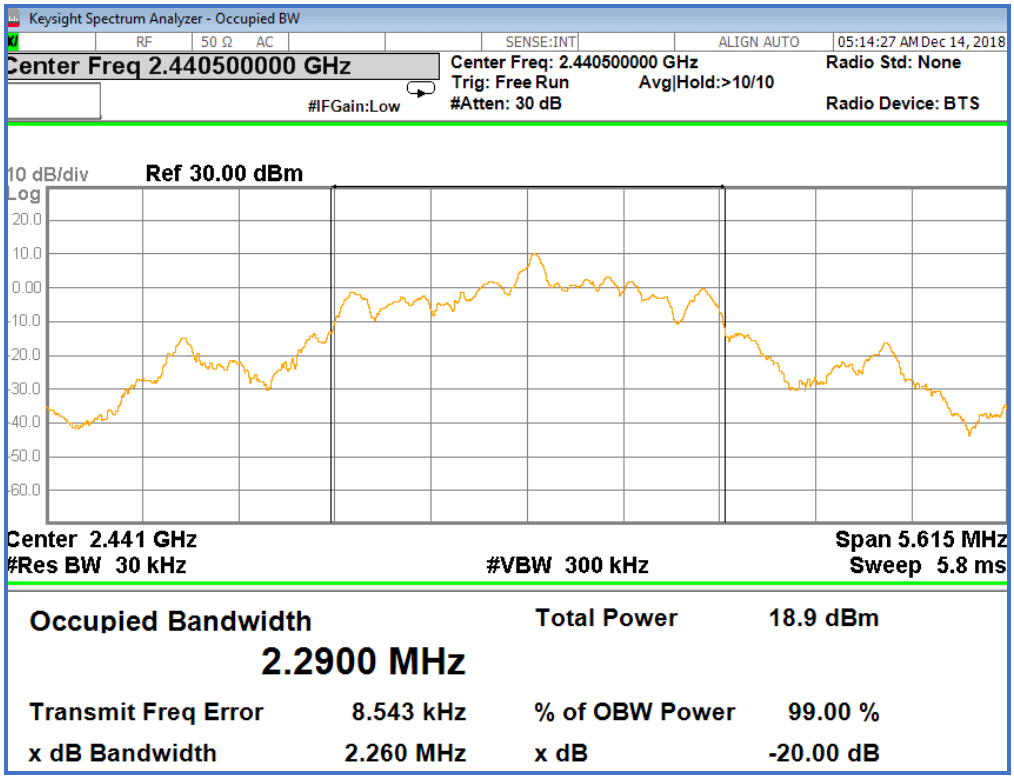
2.2.6 Channel Occupied Bandwidth Data: (Ginseng-2 Radio)

Channel	Freq. [MHz]	20 dB OBW [MHz]	99% OBW [MHz]
Low	2403.5	2.247	2.2326
Mid	2440.4	2.260	2.2900
High	2477.3	2.256	2.2566

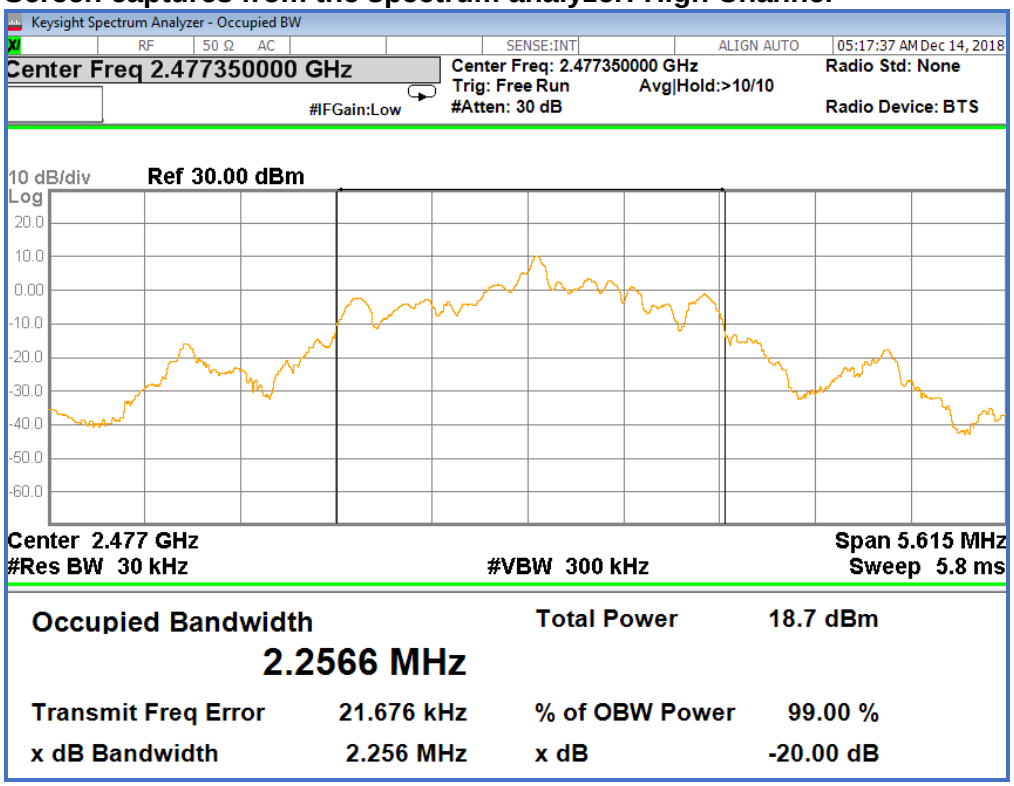
Screen captures from the spectrum analyzer: Low Channel



Screen captures from the spectrum analyzer: MID Channel



Screen captures from the spectrum analyzer: High Channel



2.3 Peak Output Power (Conducted)

Test Lab: Electronics Test Centre, Airdrie	**EUT: Soulplay**
Test Personnel: Imran Akram **Bushra Muharram**	**Standard: FCC PART 15.247** **Basic Standard: ANSI C63.10: 2013**
Date: 2018-12-14 (20.6°C,14.2 % RH)	

EUT status: Compliant

Specification: FCC Part 15.247(b, 1)

The maximum peak conducted output power of the intentional radiator shall not exceed the following:

Criteria: For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

2.3.1 Test Guidance: ANSI C63.10-2013, Clause 11.9.2.2.2, Clause 7.8.5 / DA 00-705

This measurement is performed at low, mid and high frequencies, with modulation.

The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation. The loss from the cable and the attenuator were added on the analyzer as gain offset setting there by allowing direct measurements, without the need for any further corrections.

Use the following spectrum analyzer settings:	
Span	approximately 5 times the 20 dB bandwidth, centered on a hopping channel
RBW	> the 20 dB bandwidth of the emission being measured
VBW	≥ RBW
Sweep	auto
Detector function	peak
Trace	max hold
Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power.	

2.3.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

2.3.3 Test Equipment

Testing was performed with the following equipment:

Equipment	Manufacturer	Model #	Asset #	Cal. Date	Interval	Cal. Due
EMI receiver	Agilent	N9038A	6130	2018-05-2	1 year	2019-05-2
Temp/Humidity	Extech	42270	5892	2018-04-13	1 year	2019-04-13
Attenuator	FairView Microwave	SA18N5WA-10	6886	2018-11-23	1 year	2019-11-23
DC Blocker	MCL	BLK-89-S+	-	2018-01-15	1 year	2019-01-15
CE Cable (50cm length)	Huber+Suhner	Enviroflex 400	-	2018-01-15	1 year	2019-01-15

2.3.4 Test Sample Verification, Configuration & Modifications

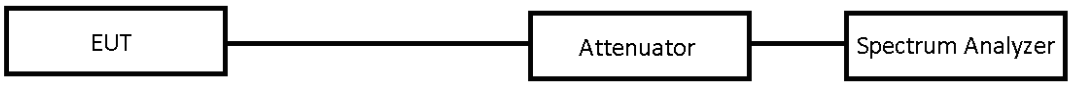
The EUT was set to a selected channel with test-specific software. The output was modulated as in normal operation.

The EUT modified to provide the direct access to antenna trace for conducted measurements.

For compliance purposes EUT met requirements without any modification

Test setup diagrams for Peak Power testing:

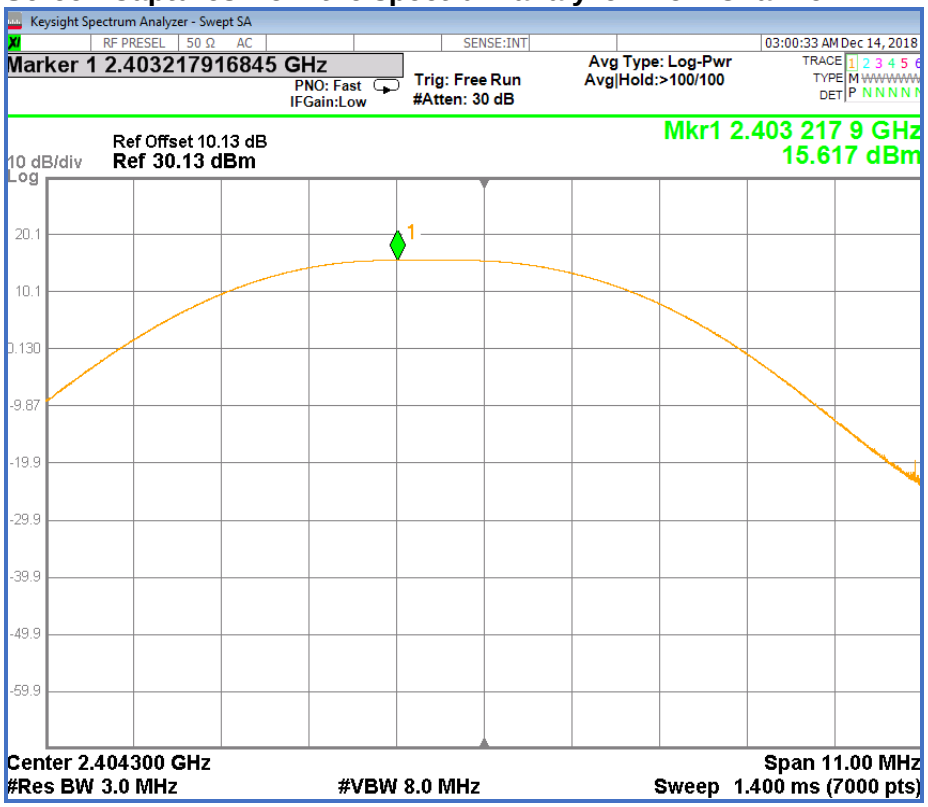
Conducted:



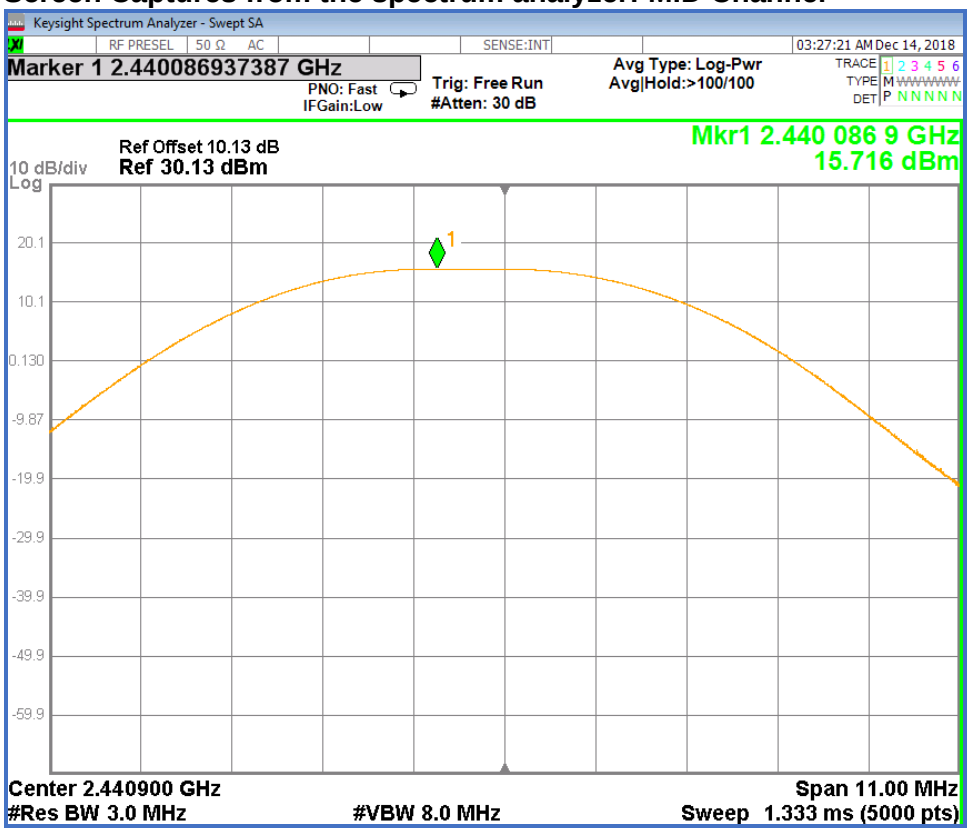
2.3.5 Peak Output Power Data (Ginseng-1 Radio)

Channel	Freq. [MHz]	Output Power measured (dBm)	Output Power Limit (dBm)	Output Power measured (mW)	Output Power Limit (mW)	Result
Low	2403.5	15.617	20.97	36.4502	125	Compliant
Mid	2440.4	15.716	20.97	37.2907	125	Compliant
High	2477.3	15.376	20.97	34.4826	125	Compliant

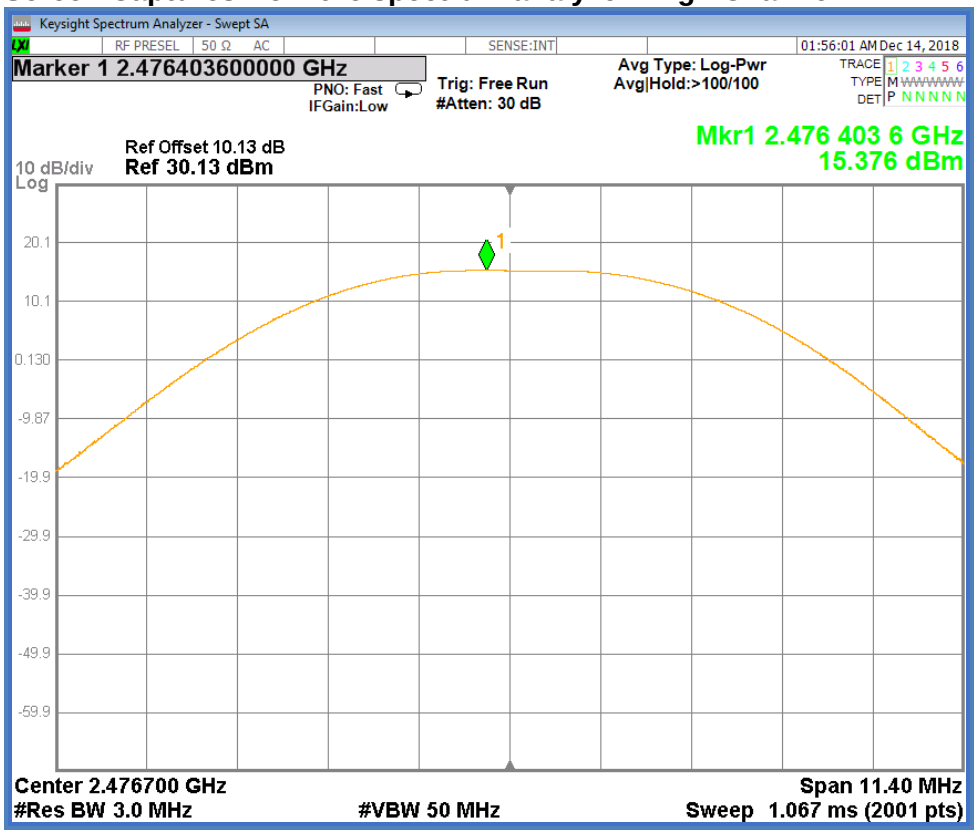
Screen Captures from the spectrum analyzer: Low Channel



Screen Captures from the spectrum analyzer: MID Channel



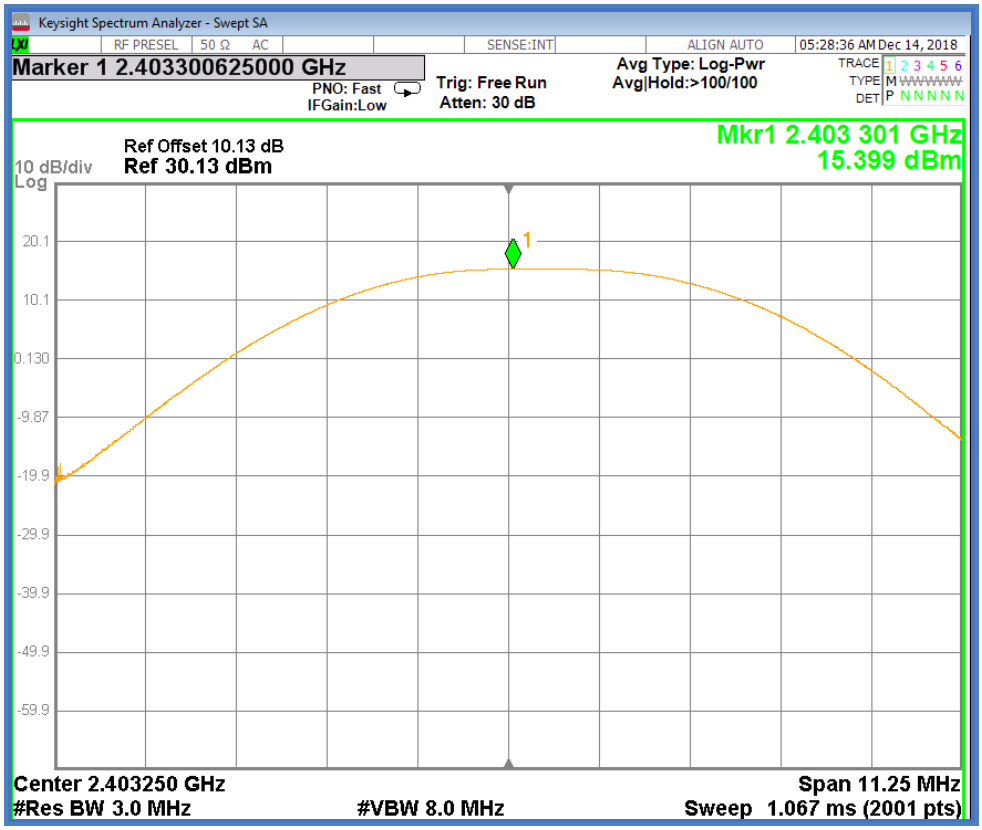
Screen Captures from the spectrum analyzer: High Channel



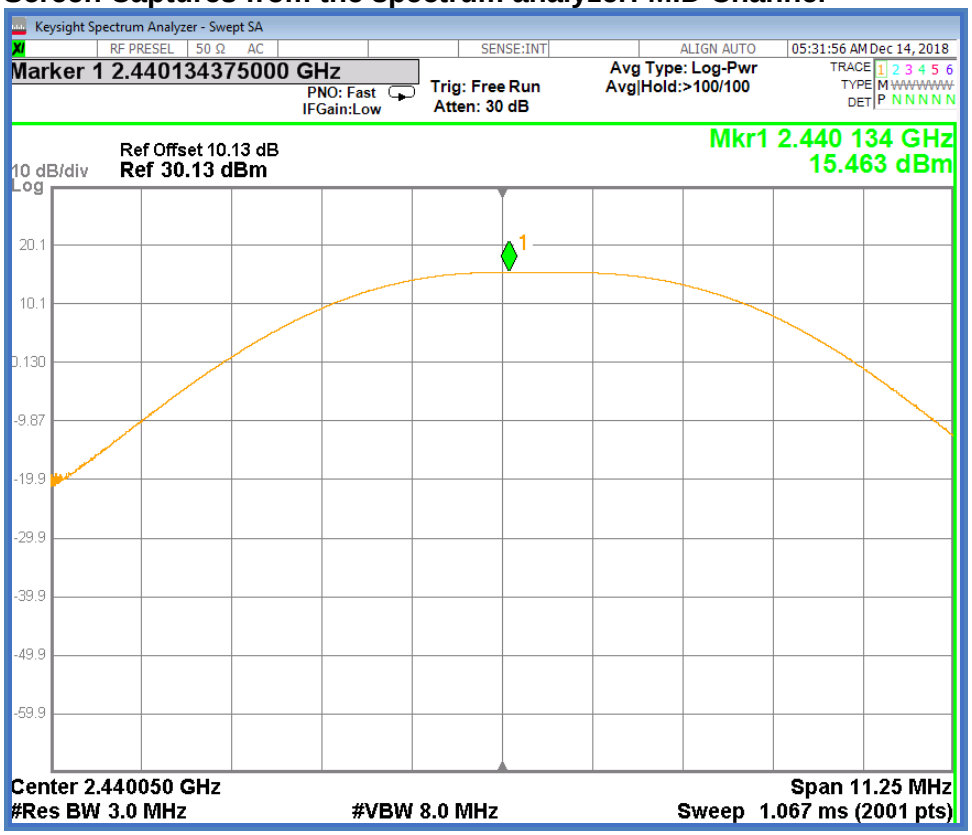
2.3.6 Peak Output Power Data (Ginseng-2 Radio)

Channel	Freq. [MHz]	Output Power measured (dBm)	Output Power Limit (dBm)	Output Power measured (mW)	Output Power Limit (mW)	Result
Low	2403.5	15.399	20.97	34.6657	125	Compliant
Mid	2440.4	15.463	20.97	35.1803	125	Compliant
High	2477.3	15.171	20.97	32.8927	125	Compliant

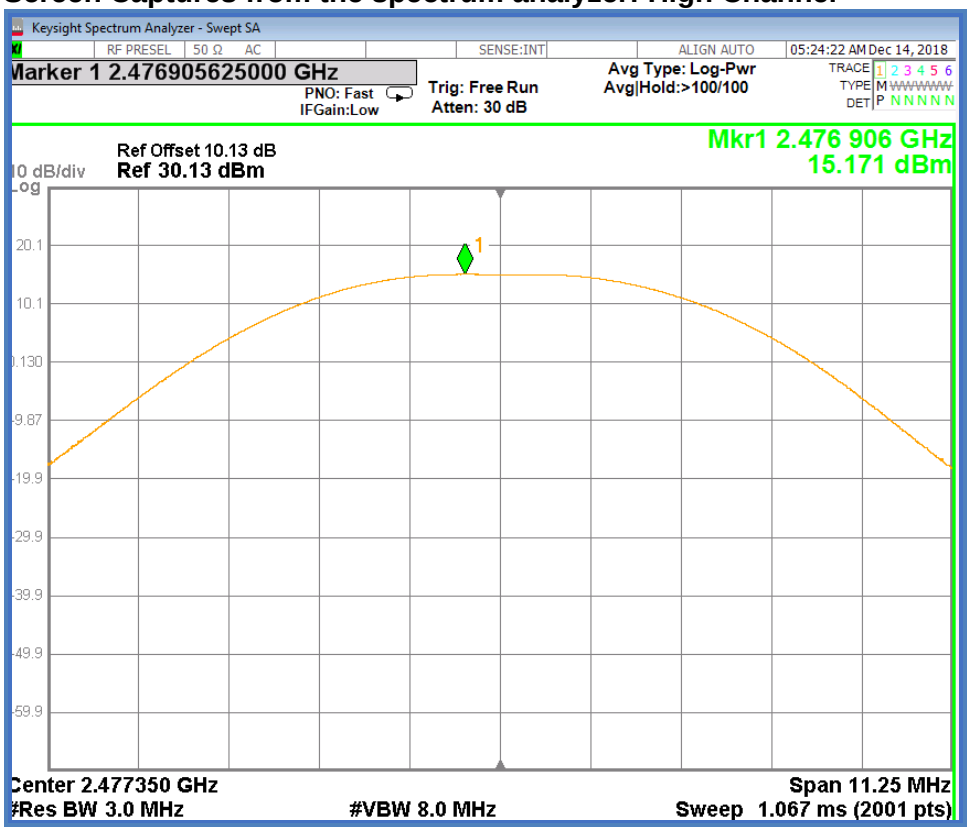
Screen Captures from the spectrum analyzer: Low Channel



Screen Captures from the spectrum analyzer: MID Channel



Screen Captures from the spectrum analyzer: High Channel



2.4 Band Edge Attenuation

Test Lab: Electronics Test Centre, Airdrie	**EUT: Soulplay**
Test Personnel: Imran Akram **Bushra Muharram**	**Standard: FCC PART 15.247**
Date: 2018-12-14 (20.6°C,14.2 % RH)	**Basic Standard: ANSI C63.10: 2013**

EUT status: Compliant

Specification: FCC Part 15.247(d)

Criteria: 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 §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

2.4.1 Test Guidance: ANSI C63.10-2013 Clause 11.13.2 & 6.10.4, 6.10.6 / DA 00-705

This measurement is performed at the low and high frequencies, with modulation.

The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation. The loss from the cable and the attenuator were added on the analyzer as gain offset setting there by allowing direct measurements, without the need for any further corrections.

Use the following spectrum analyzer settings:	
Span	wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, 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 bandedge, or on the highest modulation product outside of the band, if this level is greater than that at the bandedge. 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 specified limit. Now, using the same instrument settings, enable the hopping function of the EUT and Follow the same procedure listed above.	

2.4.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

2.4.3 Test Equipment

Testing was performed with the following equipment:

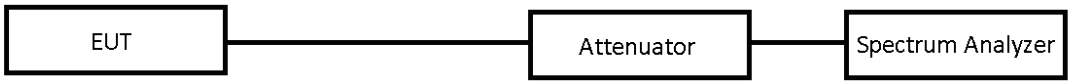
Equipment	Manufacturer	Model #	Asset #	Cal. Date	Interval	Cal. Due
EMI receiver	Agilent	N9038A	6130	2018-05-2	1 year	2019-05-2
Temp/Humidity	Extech	42270	5892	2018-04-13	1 year	2019-04-13
Attenuator	FairView Microwave	SA18N5WA-10	6886	2018-11-23	1 year	2019-11-23
DC Blocker	MCL	BLK-89-S+	-	2018-01-15	1 year	2019-01-15
CE Cable (50cm length)	Huber+Suhner	Enviroflex 400	-	2018-01-15	1 year	2019-01-15

2.4.4 Test Sample Verification, Configuration & Modifications

The EUT was set to transmit continuously on a selected channel with test-specific software. The output was modulated as in normal operation. The EUT met the requirements without modification.

Test setup diagrams for Band Edge Attenuation testing:

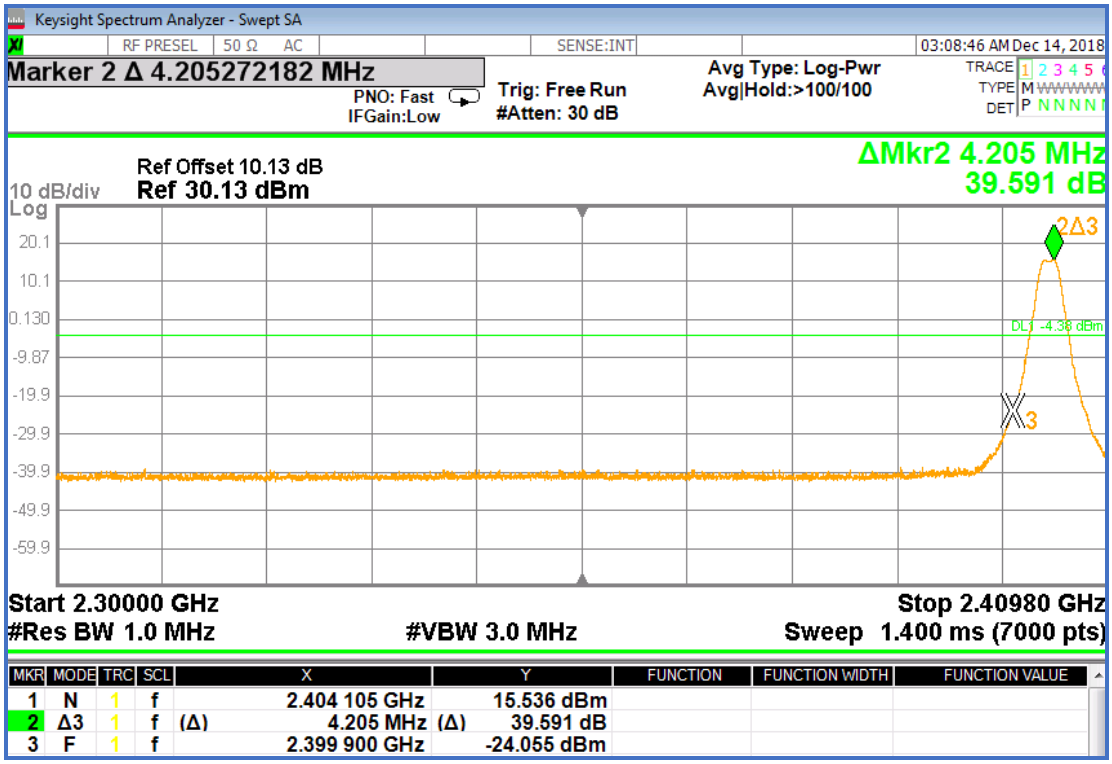
Conducted:



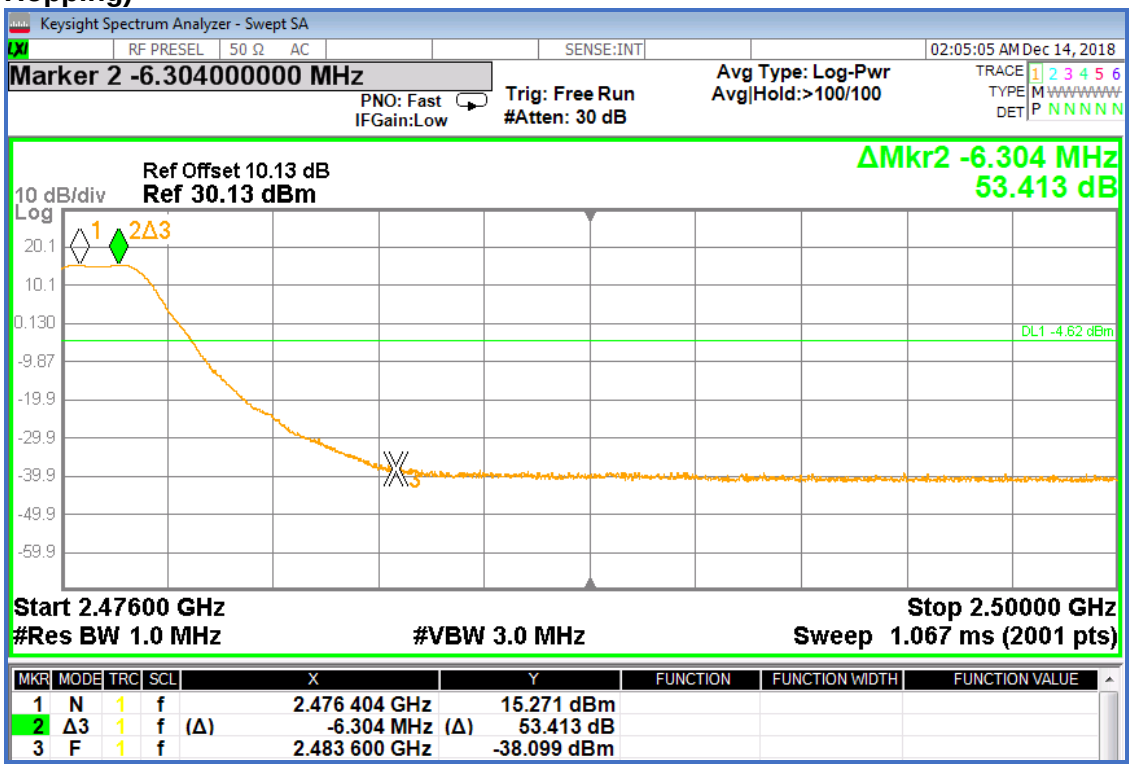
2.4.5 Band Edge Data (Ginseng-1 Radio)

Modulation	Channel	Attenuation at Band Edge	Attenuation Limit at Band Edge
(Non – Hopping)	2403.5 MHz	39.591 dBc	20 dBc
	2477.3 MHz	53.423 dBc	20 dBc
(Hopping)	2403.5 MHz	46.176 dBc	20 dBc
	2477.3 MHz	48.654 dBc	20 dBc

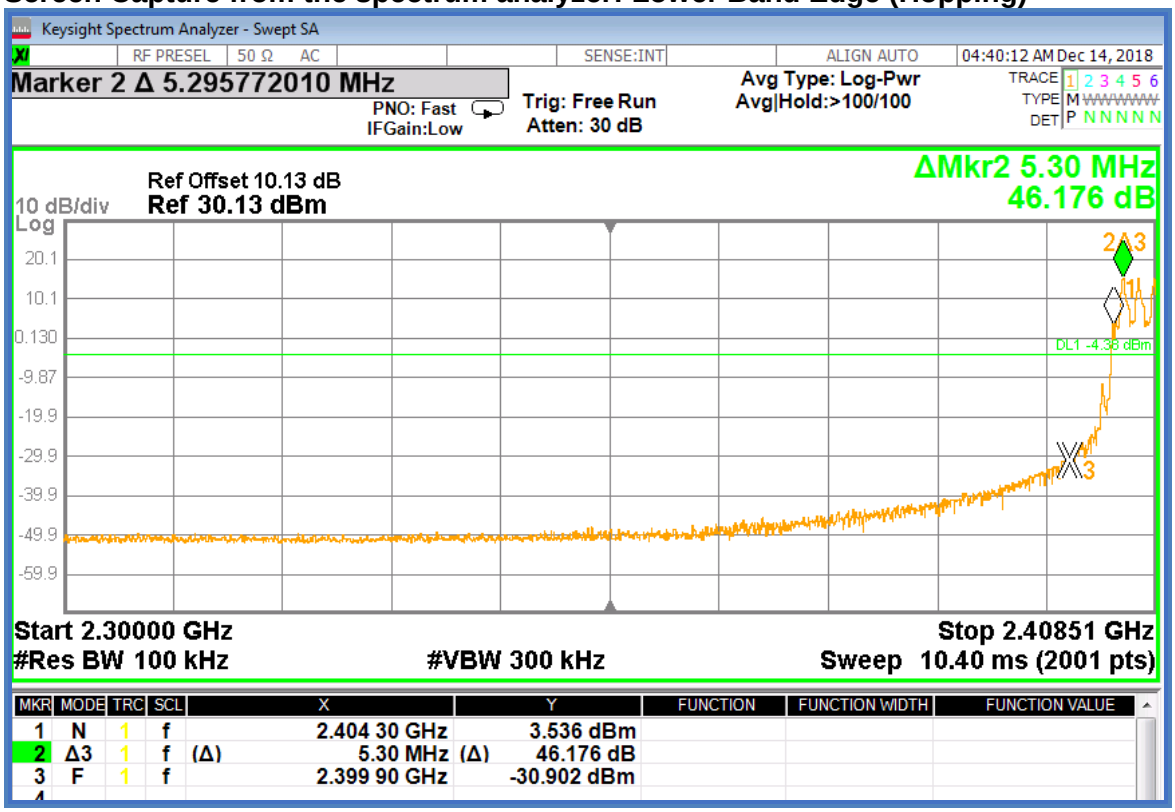
Screen Capture from the spectrum analyzer: Lower Band Edge (Non Hopping)



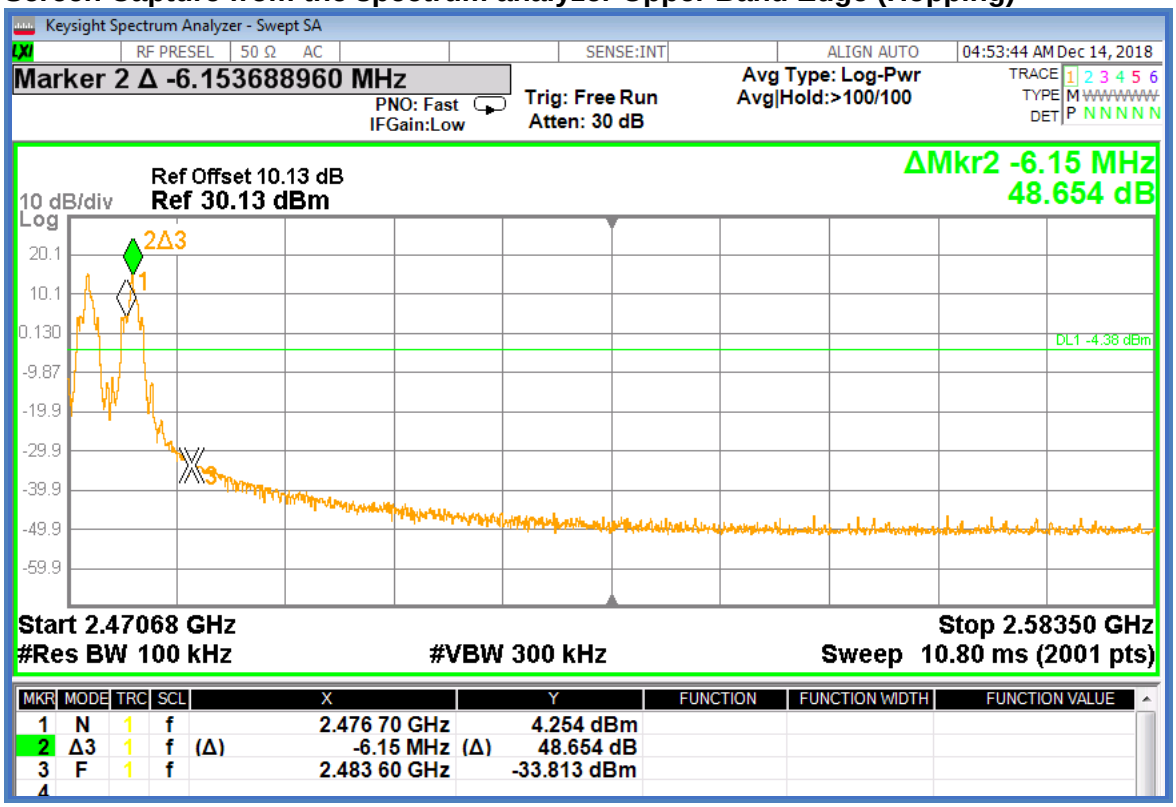
Screen Capture from the spectrum analyzer: Upper Band Edge (Non Hopping)



Screen Capture from the spectrum analyzer: Lower Band Edge (Hopping)



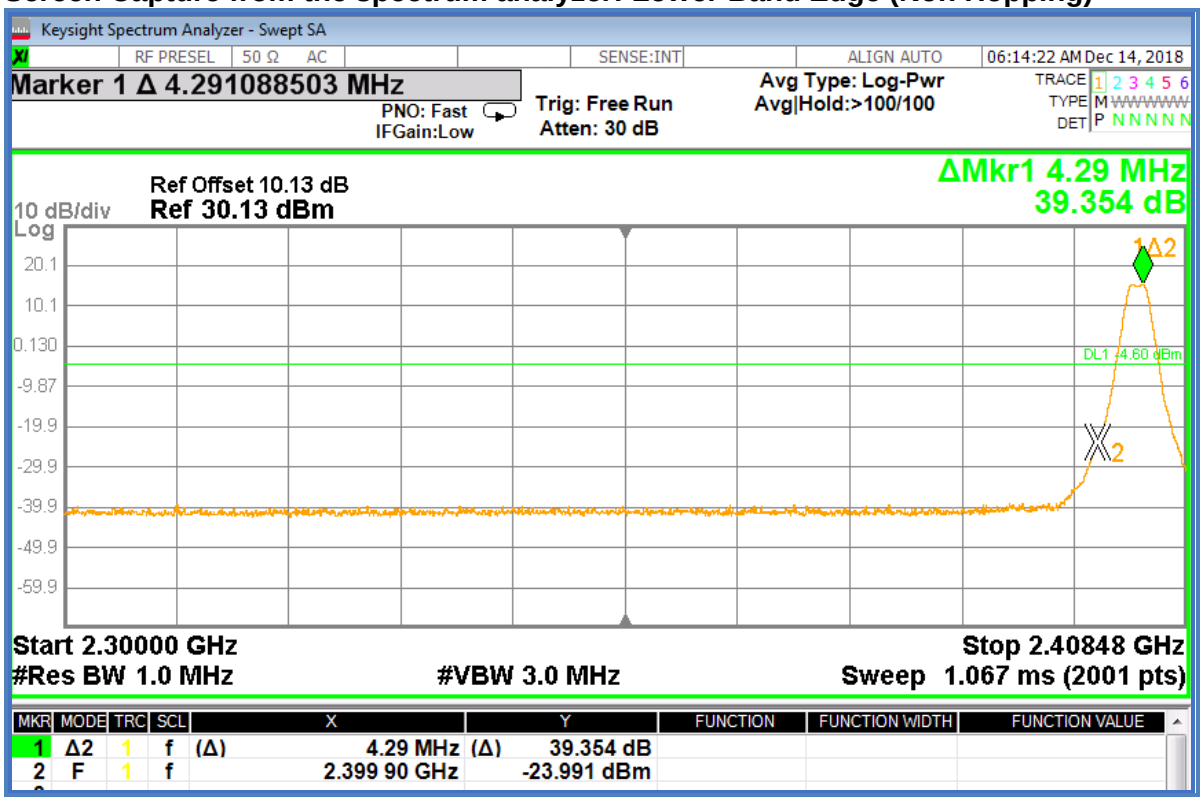
Screen Capture from the spectrum analyzer Upper Band Edge (Hopping)



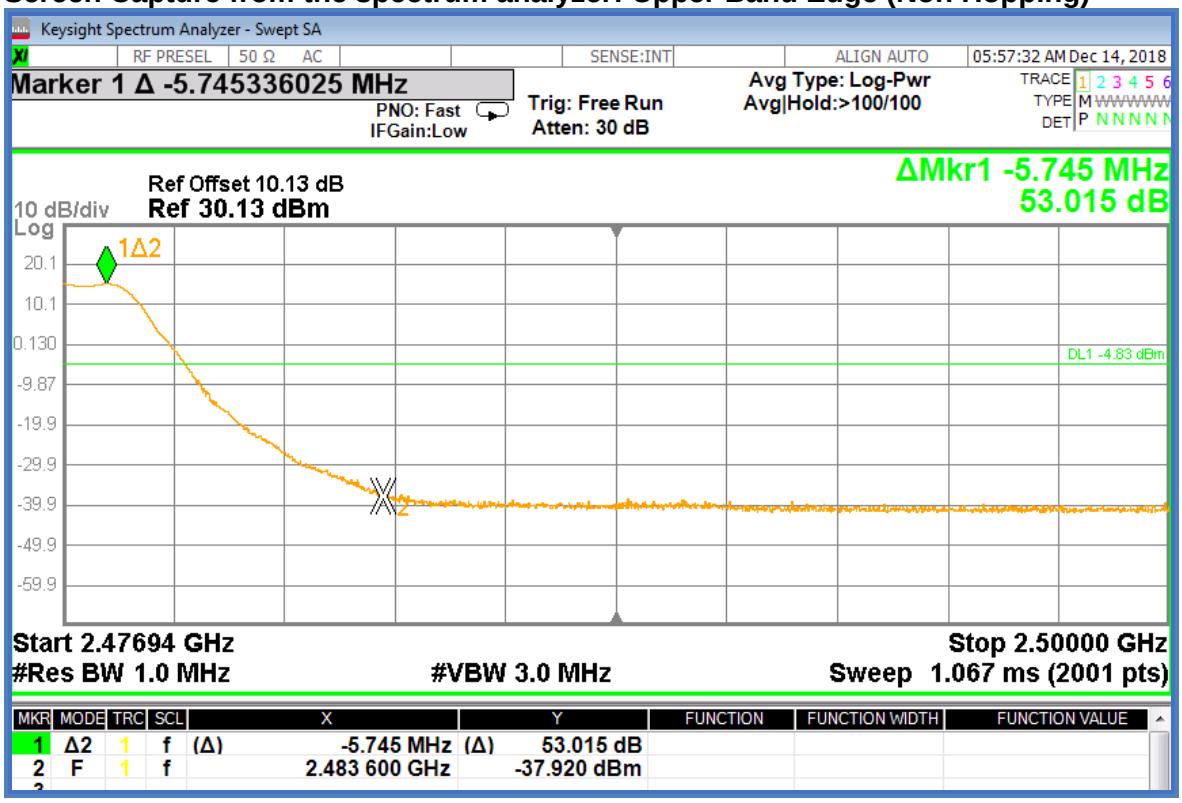
2.4.6 Band Edge Data (Ginseng-2 Radio)

Modulation	Channel	Attenuation at Band Edge	Attenuation Limit at Band Edge
(Non-Hopping)	2403.5 MHz	39.354 dBc	20 dBc
	2477.3 MHz	53.015 dBc	20 dBc
(Hopping)	2403.5 MHz	50.418 dBc	20 dBc
	2477.3 MHz	49.040 dBc	20 dBc

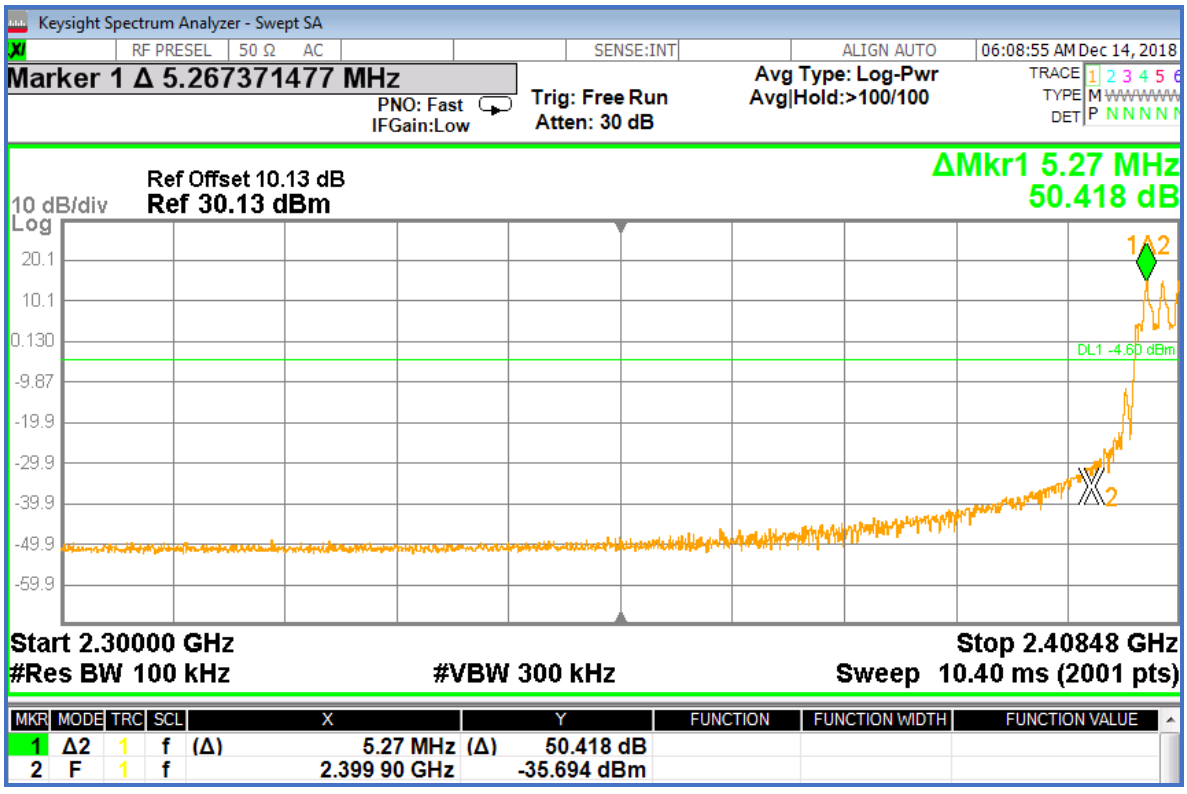
Screen Capture from the spectrum analyzer: Lower Band Edge (Non Hopping)



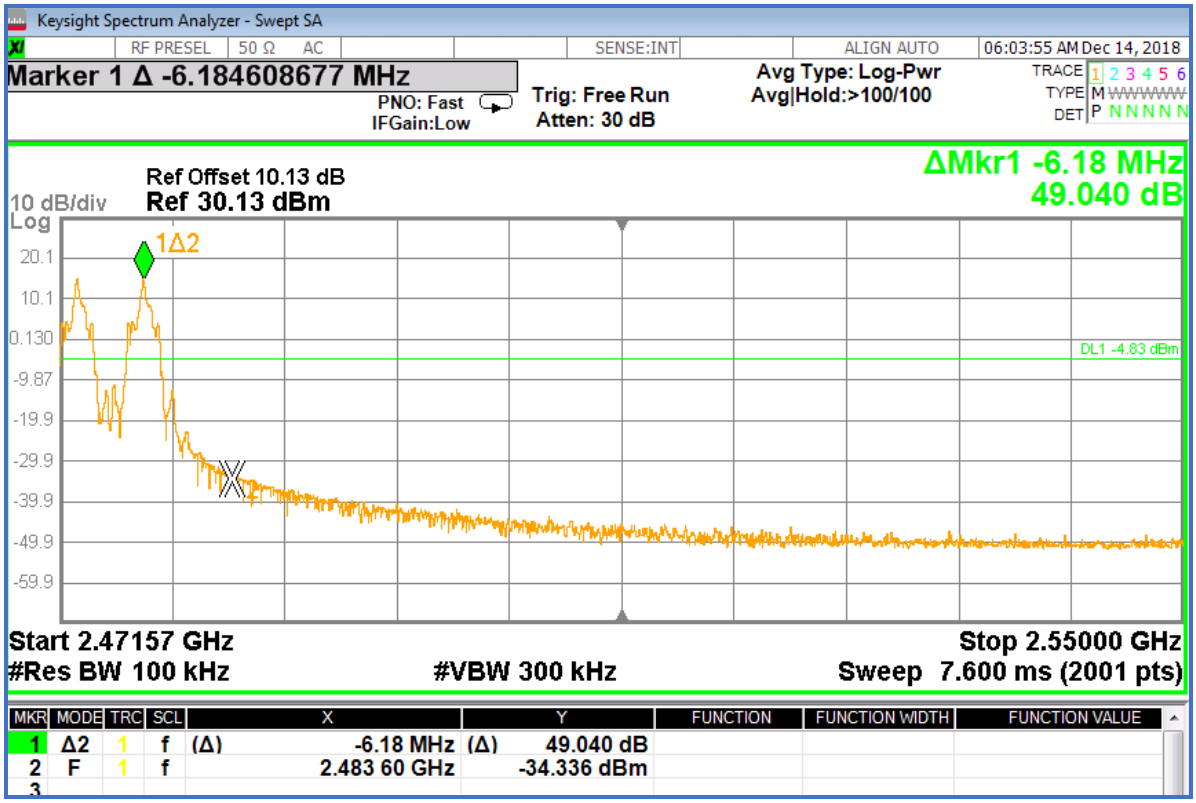
Screen Capture from the spectrum analyzer: Upper Band Edge (Non Hopping)



Screen Capture from the spectrum analyzer: Lower Band Edge (Hopping)



Screen Capture from the spectrum analyzer: Upper Band Edge (Hopping)



2.5 Conducted Harmonic and Spurious Emissions

Test Lab: Electronics Test Centre, Airdrie	**EUT: Soulplay**
Test Personnel: Imran Akram **Bushra Muharram**	**Standard: FCC PART 15.247** **Basic Standard: ANSI C63.4-2014**
Date: 2018-12-14 (20.6°C,14.2 % RH)	

EUT status: Compliant

Specification: FCC Part 15.247(d)

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.

2.5.1 Test Guidance: ANSI C63.10-2013, Clause 6.7

This measurement is performed at the low, mid and high frequencies, with modulation. The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation. The loss from the cable and the attenuator were added on the analyzer as gain offset setting there by allowing direct measurements, without the need for any further corrections.

Use the following spectrum analyzer settings:	
Span	Wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic.
RBW	100 kHz
VBW	≥ RBW
Sweep	auto
Detector function	peak
Trace	max hold
Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.	

2.5.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

2.5.3 Test Equipment

Testing was performed with the following equipment:

2.5.4 Test Sample Verification, Configuration & Modifications

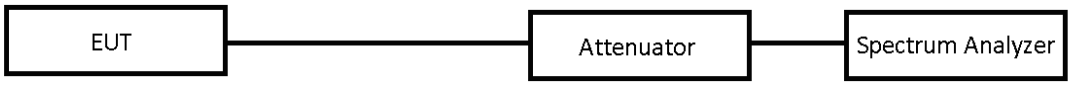
Equipment	Manufacturer	Model #	Asset #	Cal. Date	Interval	Cal. Due
EMI receiver	Agilent	N9038A	6130	2018-05-02	1 year	2019-05-02
Temp/Humidity	Extech	42270	5892	2018-04-13	1 year	2019-04-13
Attenuator	FairView Microwave	SA18N5WA-10	6886	2018-11-23	1 year	2019-11-23
2.4GHz Notch Filter	Micro-Tronics	BRM 50702	-	2018-01-15	1 year	2019-01-15
DC Blocker	MCL	BLK-89-S+	-	2018-01-15	1 year	2019-01-15
CE Cable (50cm length)	Huber+Suhner	Enviroflex 400	-	2018-01-15	1 year	2019-01-15

The EUT was set to a selected channel with test-specific software. The output was modulated as in normal operation.

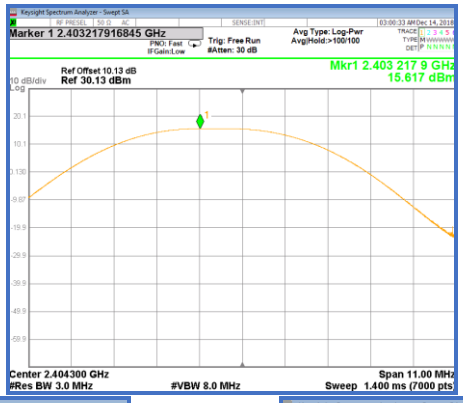
The EUT met the requirements without modification.

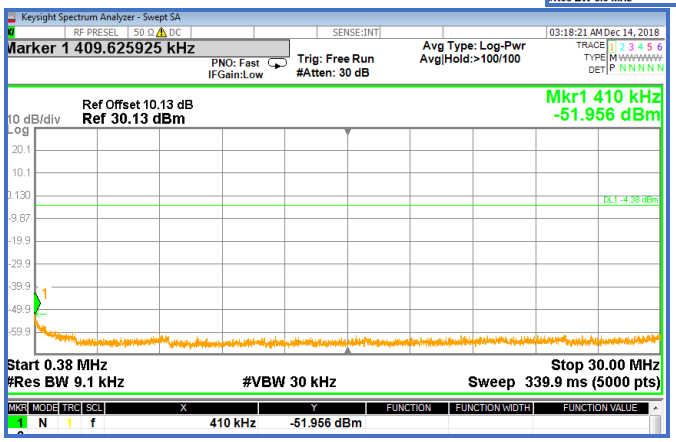
The EUT modified to provide the direct access to antenna trace for conducted measurements.

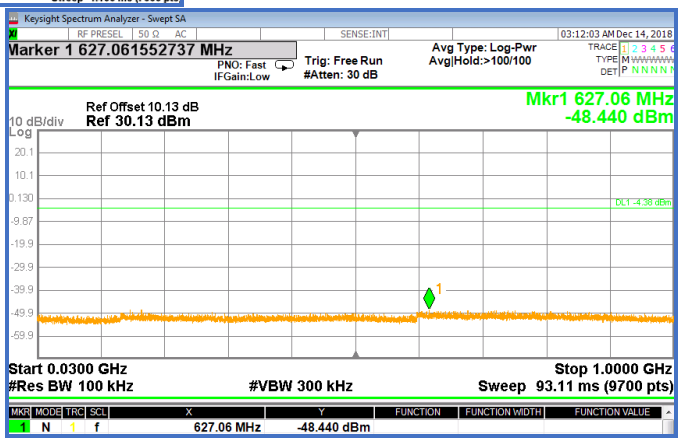
Test setup diagram for Conducted Spurious Emissions testing:

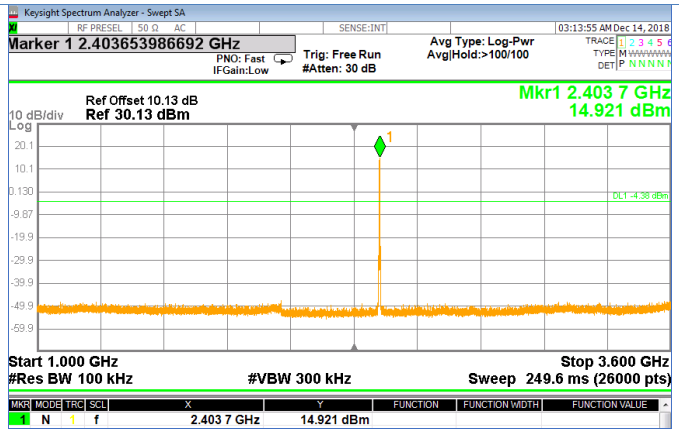


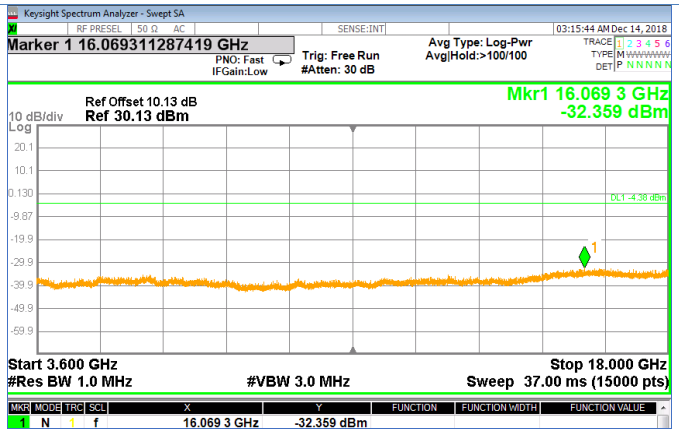
2.5.5 Conducted Emissions Data: (Ginseng-1 Radio)
Low Channel

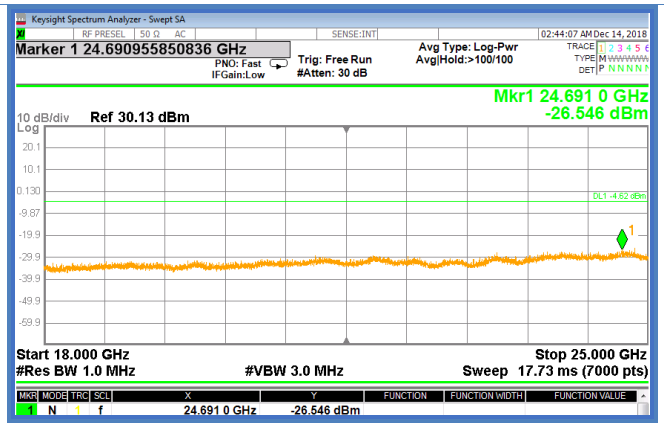




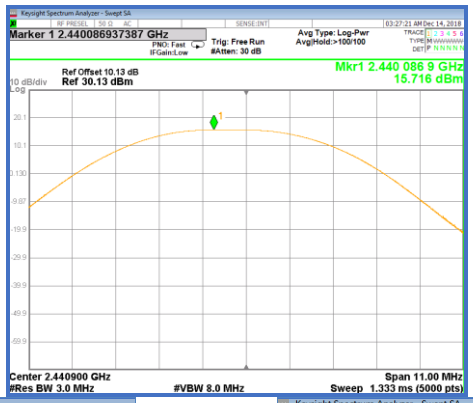


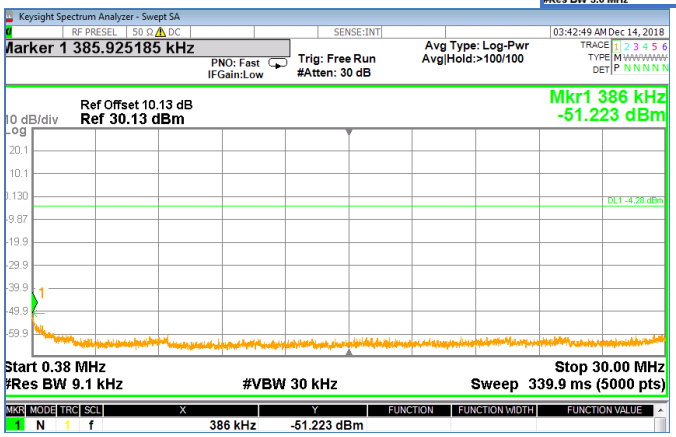


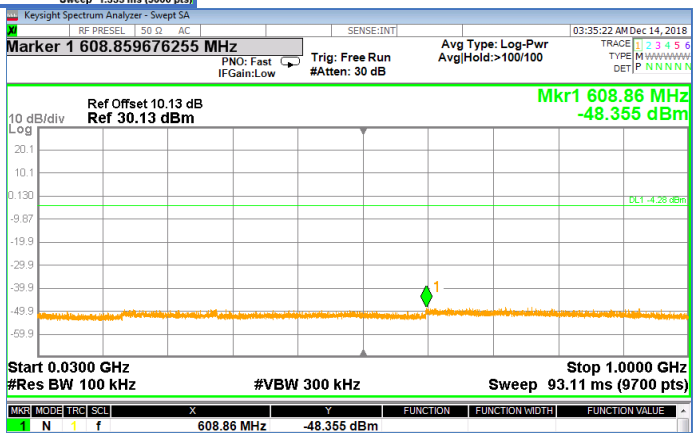


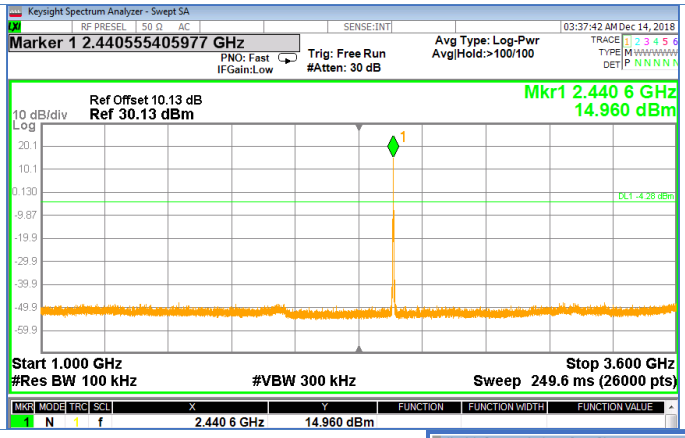


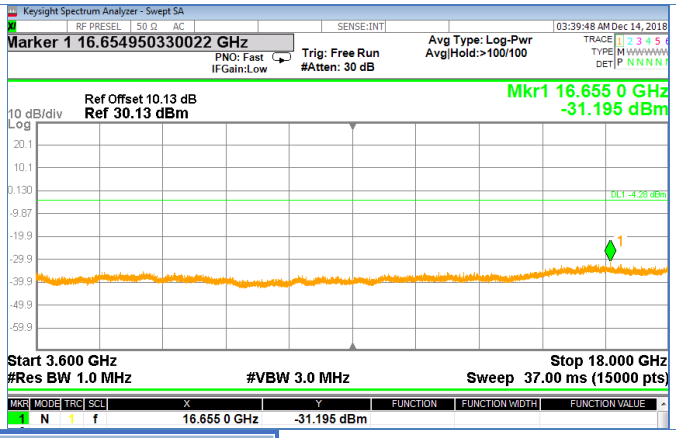
MID Channel

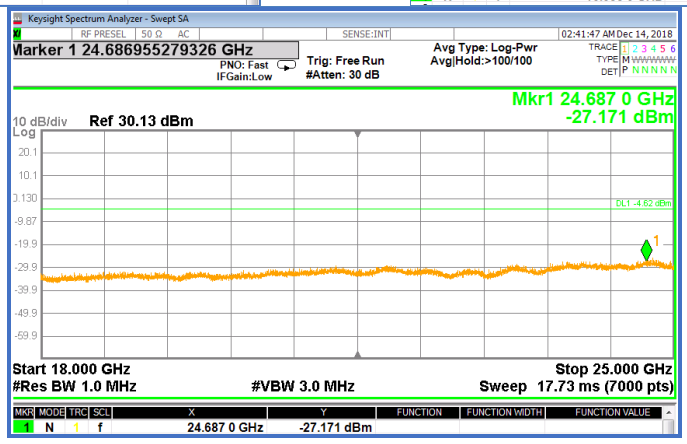

Marker 1 2.440086937387 GHz
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 2.440 086 9 GHz
15.716 dBm
Ref Offset 10.13 dB
10 dB/div
Ref 30.13 dBm
Center 2.440900 GHz
#Res BW 3.0 MHz
#VBW 8.0 MHz
Span 11.00 MHz
Sweep 1.333 ms (5000 pts)


Marker 1 385.925185 kHz
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 386 kHz
-51.223 dBm
Ref Offset 10.13 dB
10 dB/div
Ref 30.13 dBm
Start 0.38 MHz
#Res BW 9.1 kHz
#VBW 30 kHz
Stop 30.00 MHz
Sweep 339.9 ms (5000 pts)
1 N 1 f 386 kHz -51.223 dBm

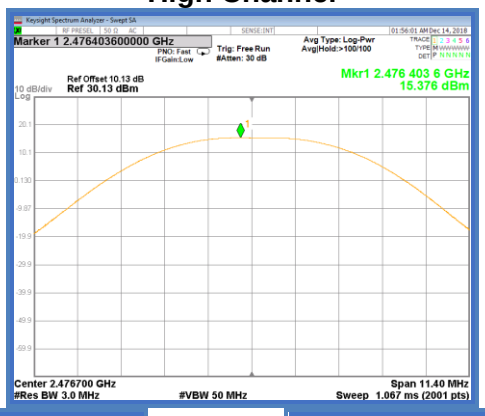

Marker 1 608.859676255 MHz
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 608.86 MHz
-48.355 dBm
Ref Offset 10.13 dB
10 dB/div
Ref 30.13 dBm
Start 0.0300 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 1.0000 GHz
Sweep 93.11 ms (9700 pts)
1 N 1 f 608.86 MHz -48.355 dBm

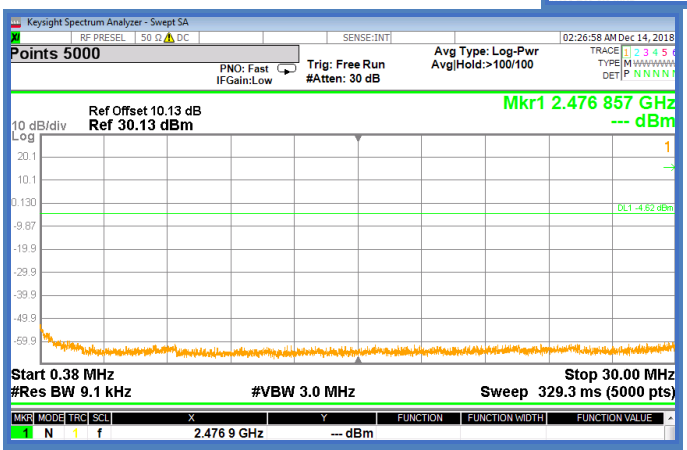

Marker 1 2.440555405977 GHz
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 2.440 6 GHz
14.960 dBm
Ref Offset 10.13 dB
10 dB/div
Ref 30.13 dBm
Start 1.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 3.600 GHz
Sweep 249.6 ms (26000 pts)
1 N 1 f 2.440 6 GHz 14.960 dBm

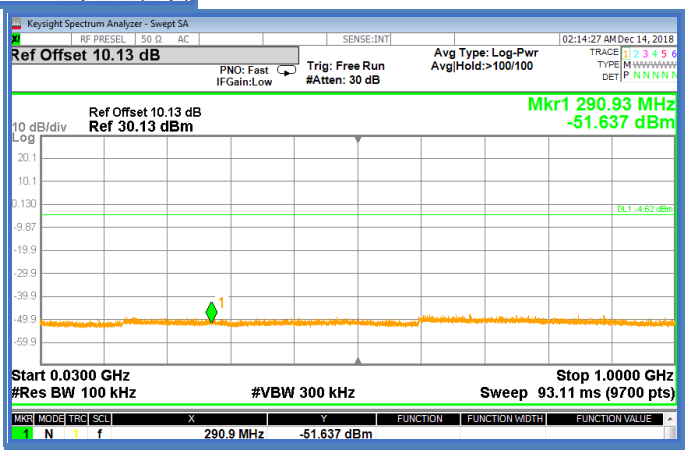

Marker 1 16.654950330022 GHz
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 16.655 0 GHz
-31.195 dBm
Ref Offset 10.13 dB
10 dB/div
Ref 30.13 dBm
Start 3.600 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 18.000 GHz
Sweep 37.00 ms (15000 pts)
1 N 1 f 16.655 0 GHz -31.195 dBm

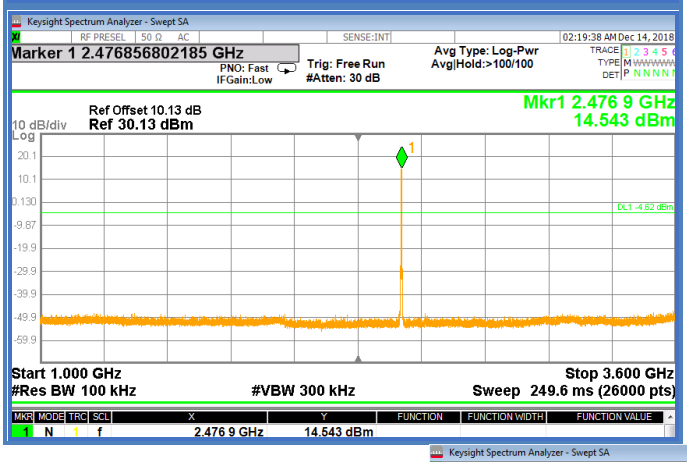

Marker 1 24.686955279326 GHz
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 24.687 0 GHz
-27.171 dBm
10 dB/div
Ref 30.13 dBm
Start 18.000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 25.000 GHz
Sweep 17.73 ms (7000 pts)
1 N 1 f 24.687 0 GHz -27.171 dBm

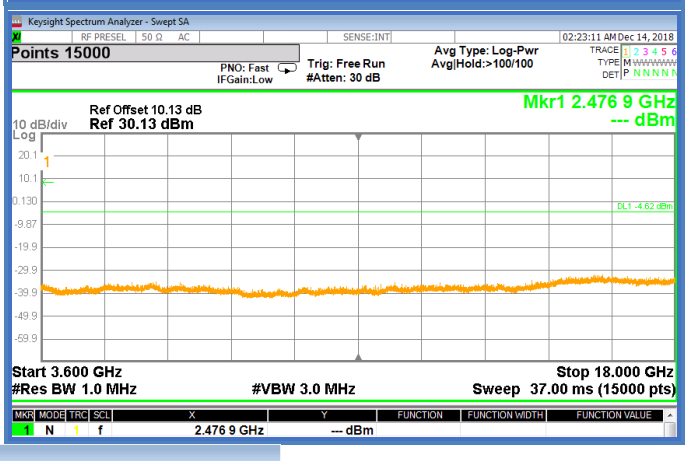
High Channel

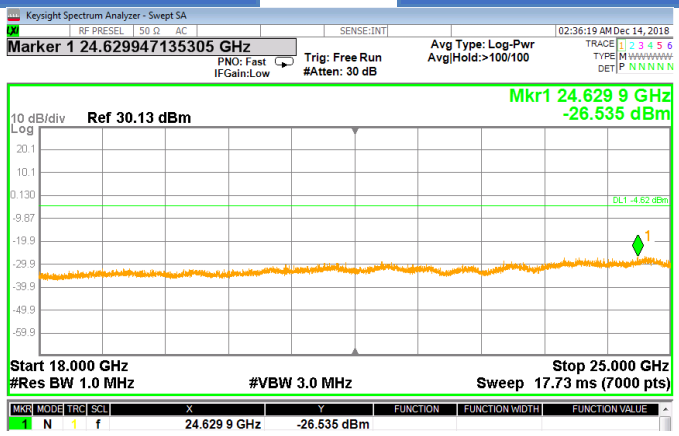






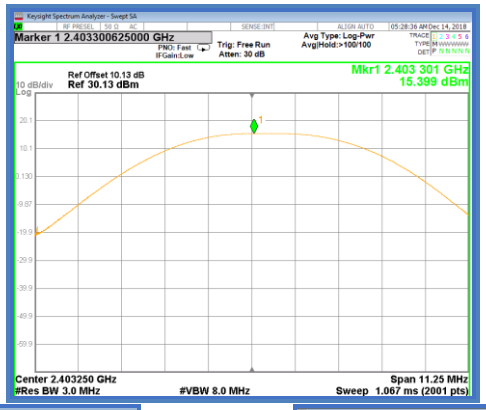


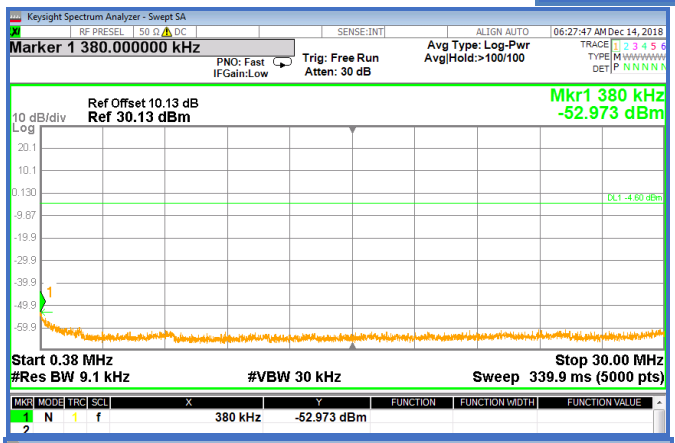


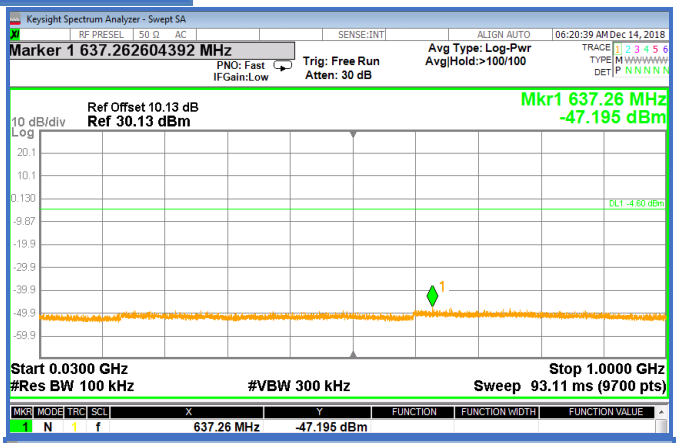


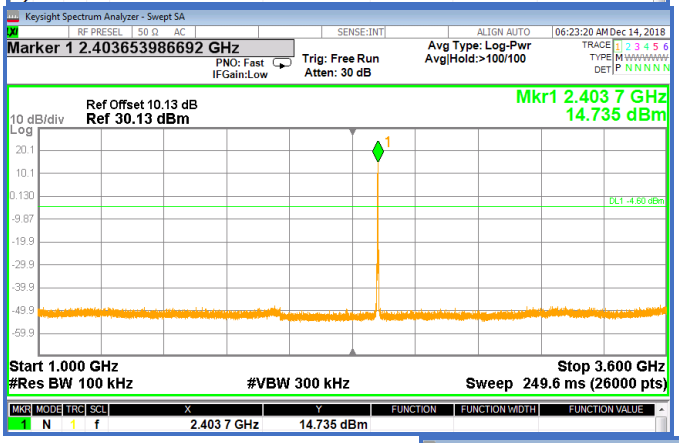
2.5.6 Conducted Emissions Data: (Ginseng-2 Radio)

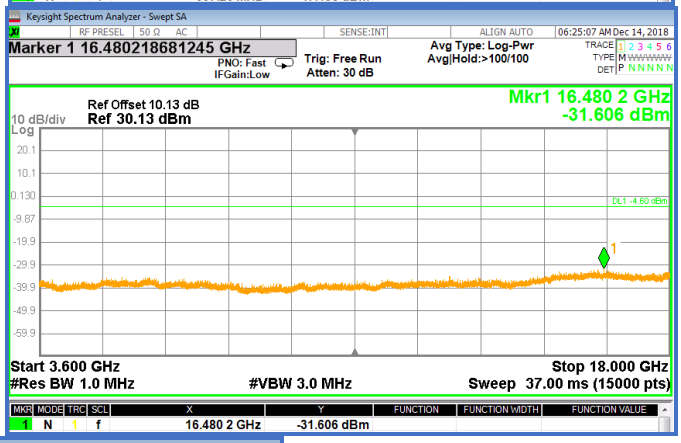
Low Channel

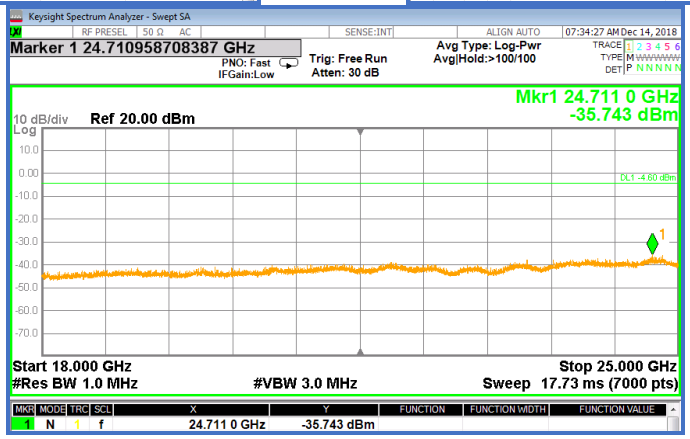




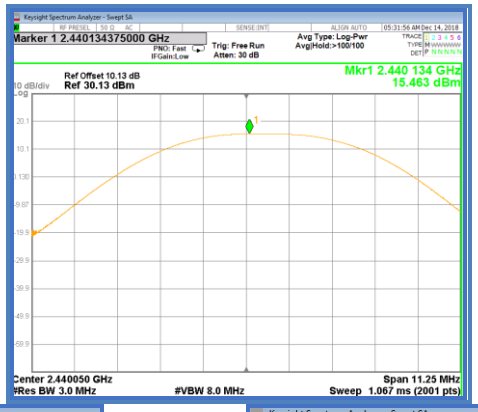


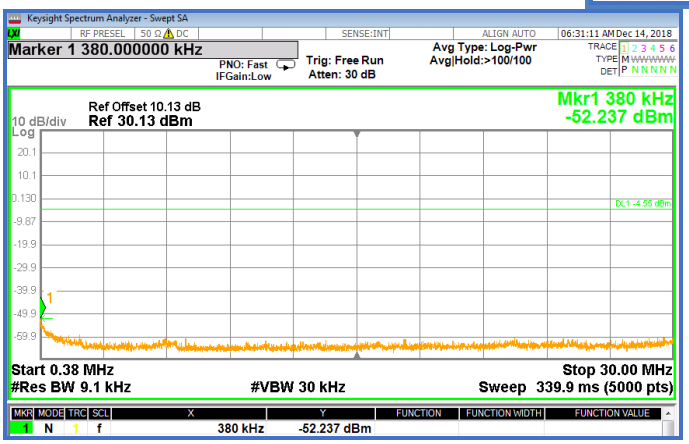


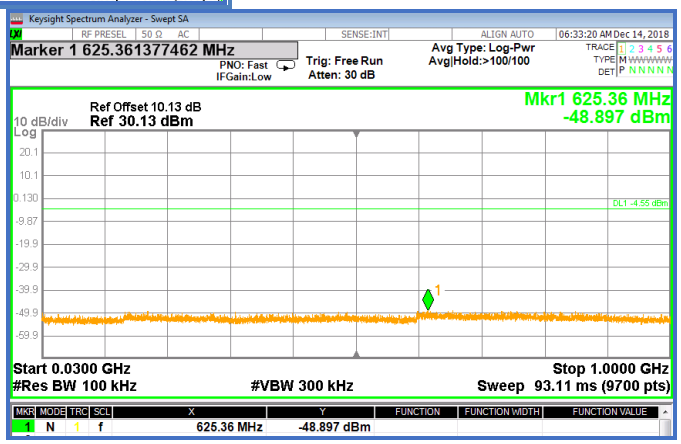


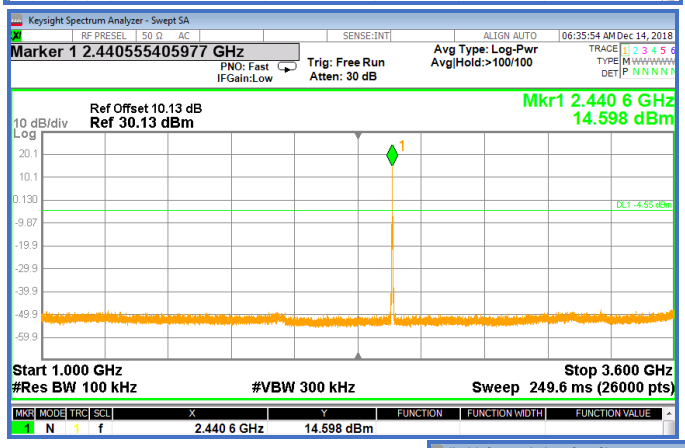


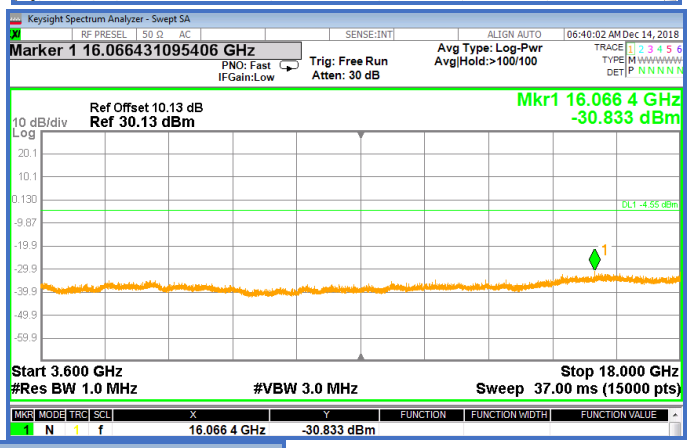
MID Channel

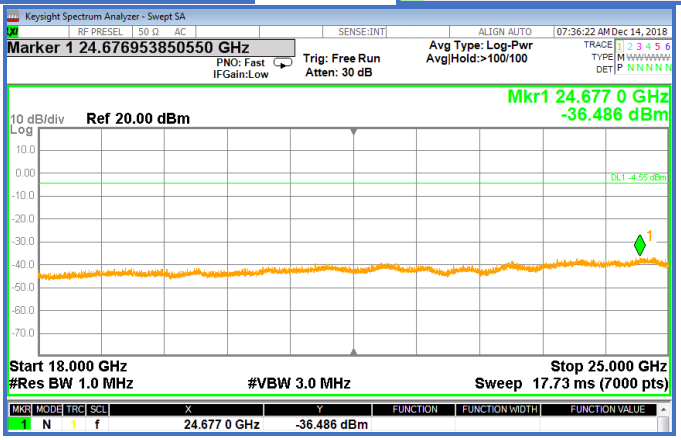

Keysight Spectrum Analyzer - Swept SA
Marker 1 2.440134375000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 2.440 134 GHz
15.463 dBm
Ref Offset 10.13 dB
10 dB/div
Ref 30.13 dBm
Center 2.440050 GHz
#Res BW 3.0 MHz
#VBW 8.0 MHz
Span 11.25 MHz
Sweep 1.067 ms (2001 pts)


Keysight Spectrum Analyzer - Swept SA
Marker 1 380.000000 kHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 380 kHz
-52.237 dBm
Ref Offset 10.13 dB
10 dB/div
Ref 30.13 dBm
Start 0.38 MHz
#Res BW 9.1 kHz
#VBW 30 kHz
Stop 30.00 MHz
Sweep 339.9 ms (5000 pts)
1 N 1 f 380 kHz -52.237 dBm

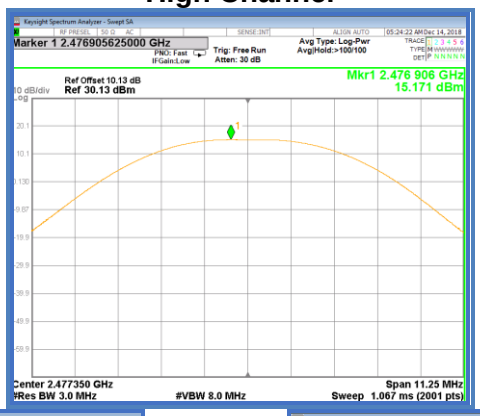

Keysight Spectrum Analyzer - Swept SA
Marker 1 625.361377462 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 625.36 MHz
-48.897 dBm
Ref Offset 10.13 dB
10 dB/div
Ref 30.13 dBm
Start 0.0300 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 1.0000 GHz
Sweep 93.11 ms (9700 pts)
1 N 1 f 625.36 MHz -48.897 dBm

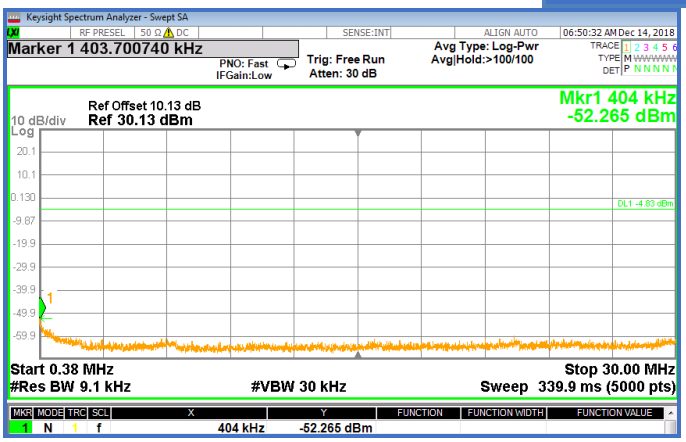

Keysight Spectrum Analyzer - Swept SA
Marker 1 2.440555405977 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 2.440 6 GHz
14.598 dBm
Ref Offset 10.13 dB
10 dB/div
Ref 30.13 dBm
Start 1.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 3.600 GHz
Sweep 249.6 ms (26000 pts)
1 N 1 f 2.440 6 GHz 14.598 dBm

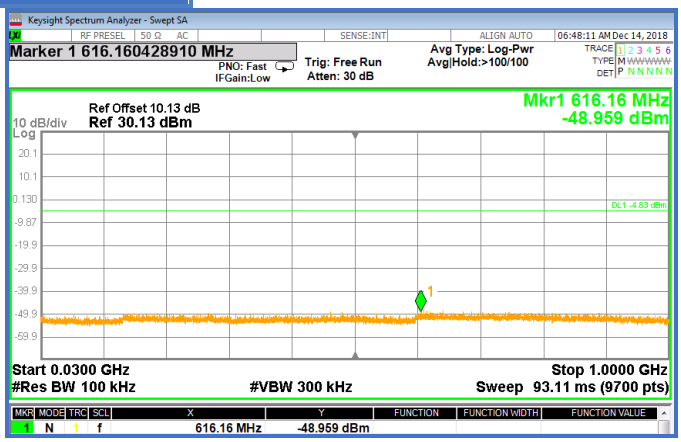

Keysight Spectrum Analyzer - Swept SA
Marker 1 16.066431095406 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 16.066 4 GHz
-30.833 dBm
Ref Offset 10.13 dB
10 dB/div
Ref 30.13 dBm
Start 3.600 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 18.000 GHz
Sweep 37.00 ms (15000 pts)
1 N 1 f 16.066 4 GHz -30.833 dBm

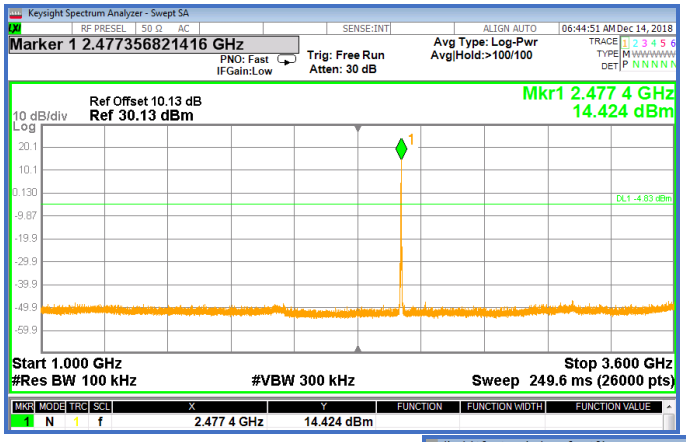

Keysight Spectrum Analyzer - Swept SA
Marker 1 24.676953850550 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 24.677 0 GHz
-36.486 dBm
10 dB/div
Ref 20.00 dBm
Start 18.000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 25.000 GHz
Sweep 17.73 ms (7000 pts)
1 N 1 f 24.677 0 GHz -36.486 dBm

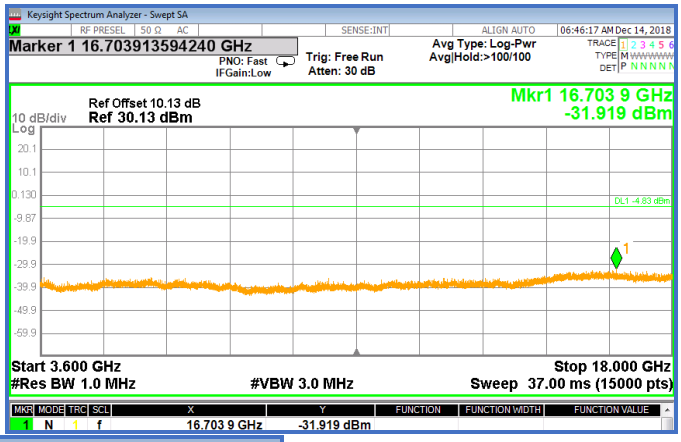
High Channel

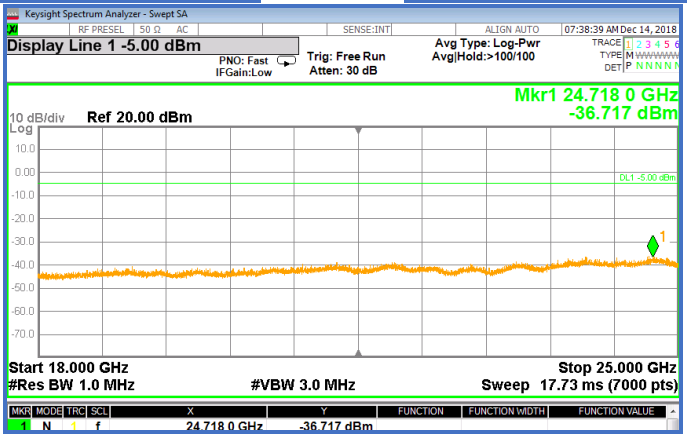












2.6 Channel Separation

Test Lab: Electronics Test Centre, Airdrie	**EUT: Soulplay**
Test Personnel: Imran Akram **Bushra Muharram**	**Standard: FCC Part 15.247** **Basic Standard: ANSI C63.10: 2013**
Date: 2018-12-14 (20.6°C,14.2% RH)	

EUT status: Compliant

Specification: FCC Part 15.247(a, 1)

Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

2.6.1 Test Guidance: ANSI 63.10 Clause 7.8.2/FCC DA 00-705

The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation. The loss from the cable and the attenuator were added on the analyzer as gain offset setting there by allowing direct measurements, without the need for any further corrections.

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:	
Span	wide enough to capture the peaks of two adjacent channels.
RBW	≥ 1% of the span
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.	

2.6.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

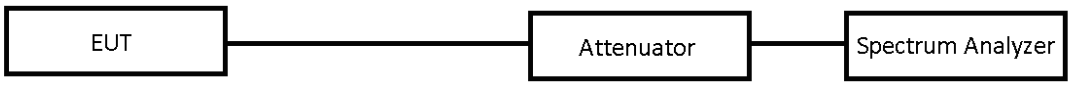
2.6.3 Test Equipment

Testing was performed with the following equipment:

Equipment	Manufacturer	Model #	Asset #	Cal. Date	Interval	Cal. Due
EMI receiver	Agilent	N9038A	6130	2018-05-02	1 year	2019-05-02
Temp/Humidity	Extech	42270	5892	2018-04-13	1 year	2019-04-13
Attenuator	FairView Microwave	SA18N5WA-10	6886	2018-11-23	1 year	2019-11-23
DC Blocker	MCL	BLK-89-S+	-	2018-01-15	1 year	2019-01-15
CE Cable (50cm length)	Huber+Suhner	Enviroflex 400	-	2018-01-15	1 year	2019-01-15

2.6.4 Test Sample Verification, Configuration & Modifications

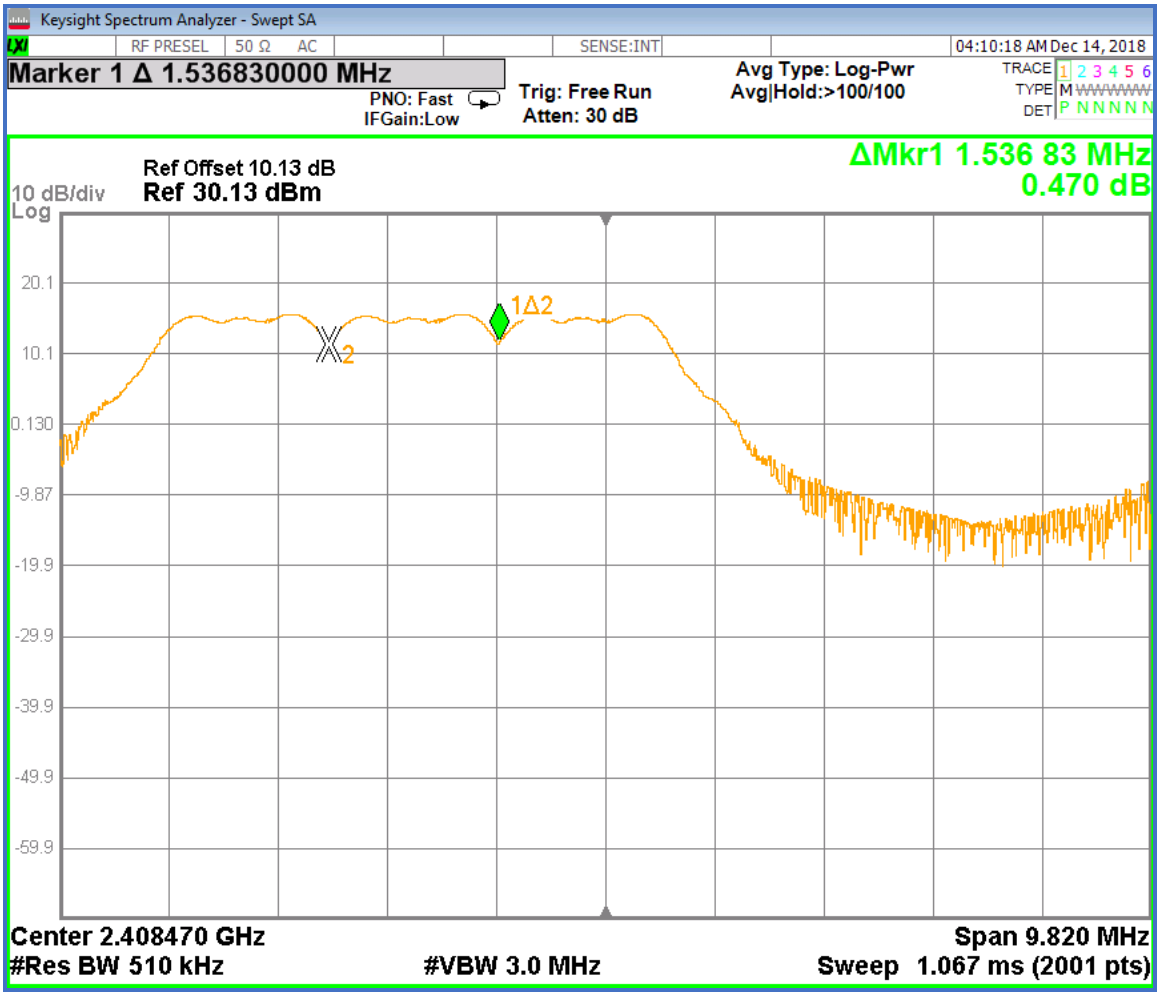
EUT configuration for Channel Separation testing:



2.6.5 Channel Separation Data: (Ginseng-1 Radio)

Compliant: The channel separation measured for this device is 1.53683 MHz

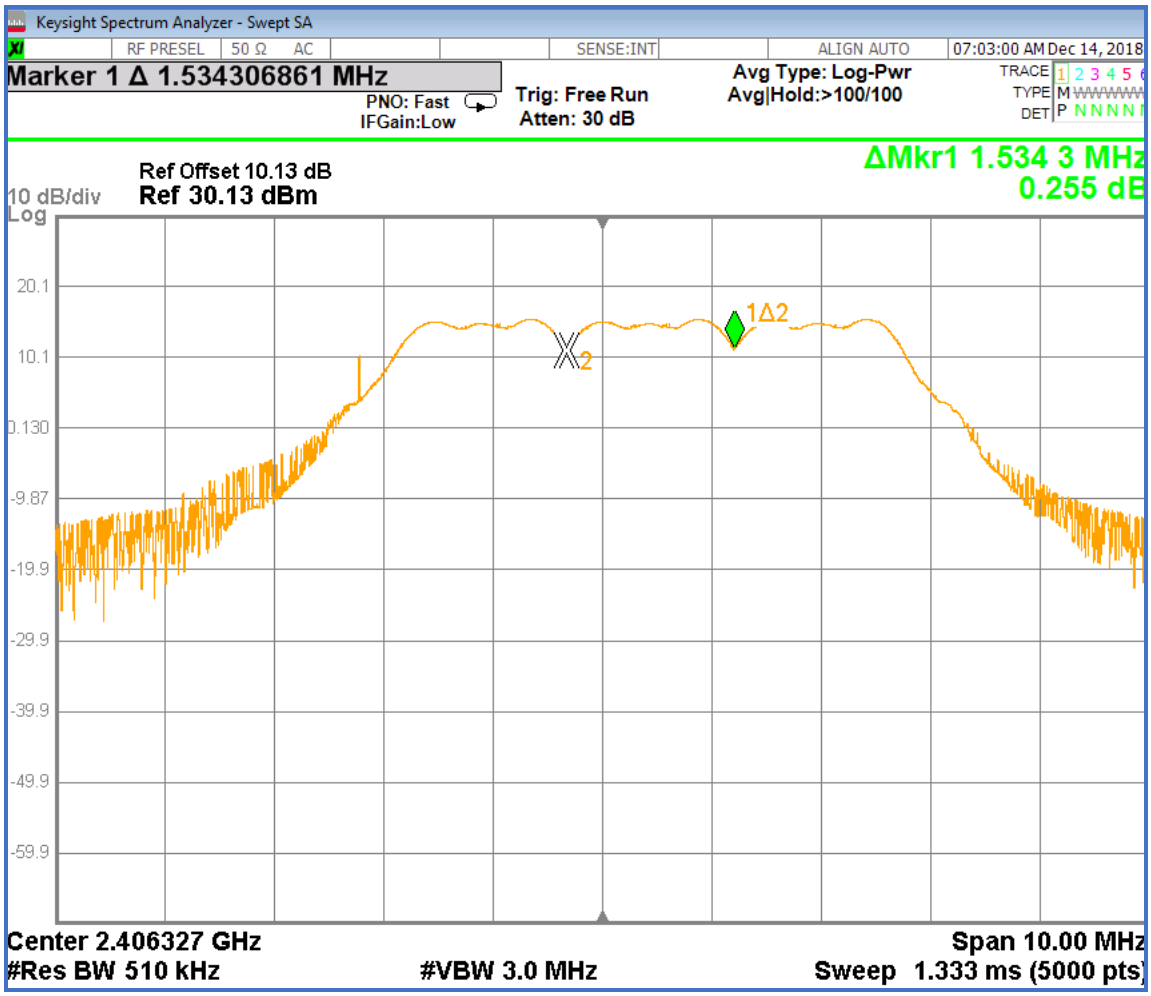
Screen Captures from the spectrum analyzer:



2.6.6 Channel Separation Data: (Ginseng-2 Radio)

Compliant: The channel separation measured for this device is 1.5343 MHz

Screen Captures from the spectrum analyzer:



2.7 Number of Hopping Channels

Test Lab: Electronics Test Centre, Airdrie	**EUTSoulplay**
Test Personnel: Imran Akram **Bushra Muharram**	**Standard: FCC Part 15.247**
	Basic Standard: ANSI C63.10: 2013
Date: 2018-12-14 (20.6°C,14.2 % RH)	**Number of Channels: 15**

EUT status: Compliant

Specification: FCC Part 15.247 [a, 1(iii)]

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

2.7.1 Test Guidance: ANSI 63.10 Clauses 7.8.3 / FCC DA-00-0705A1

This measurement is performed with the EUT transmitter frequency hopping function active.

The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation. The loss from the cable and the attenuator were added on the analyzer as gain offset setting there by allowing direct measurements, without the need for any further corrections.

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:	
Span	the frequency band of operation
RBW	≥ 1% of the span
VBW	≥RBW
Sweep	auto
Detector function	peak
Trace	max hold
Allow the trace to stabilize.	

2.7.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

2.7.3 Test Equipment

Testing was performed with the following equipment:

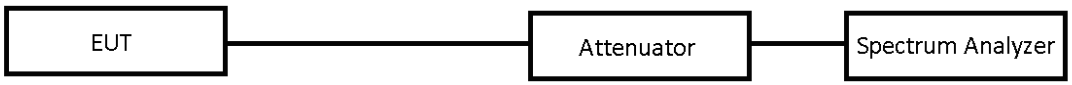
Equipment	Manufacturer	Model #	Asset #	Cal. Date	Interval	Cal. Due
EMI receiver	Agilent	N9038A	6130	2018-05-02	1 year	2019-05-02
Temp/Humidity	Extech	42270	5892	2018-04-13	1 year	2019-04-13
Attenuator	FairView Microwave	SA18N5WA-10	6886	2018-11-23	1 year	2019-11-23
DC Blocker	MCL	BLK-89-S+	-	2018-01-15	1 year	2019-01-15
CE Cable (50cm length)	Huber+Suhner	Enviroflex 400	-	2018-01-15	1 year	2019-01-15

2.7.4 Test Sample Verification, Configuration & Modifications

The EUT was operating normally.

The EUT met the requirements without modification.

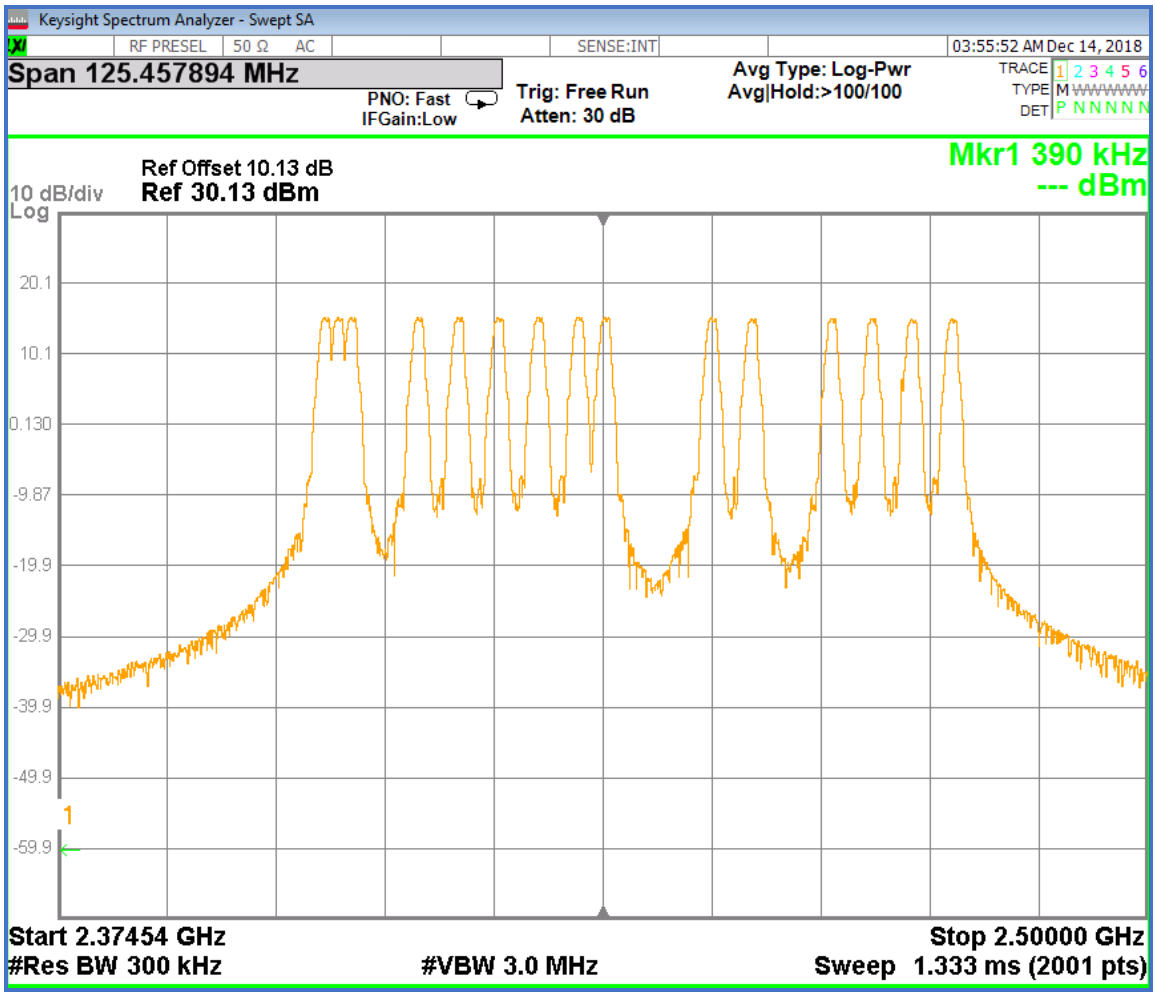
EUT configuration for Radiated Emissions testing:



2.7.5 Hopping Channel Data: (Ginseng-1 Radio)

<u>There are 15 hopping channels</u>

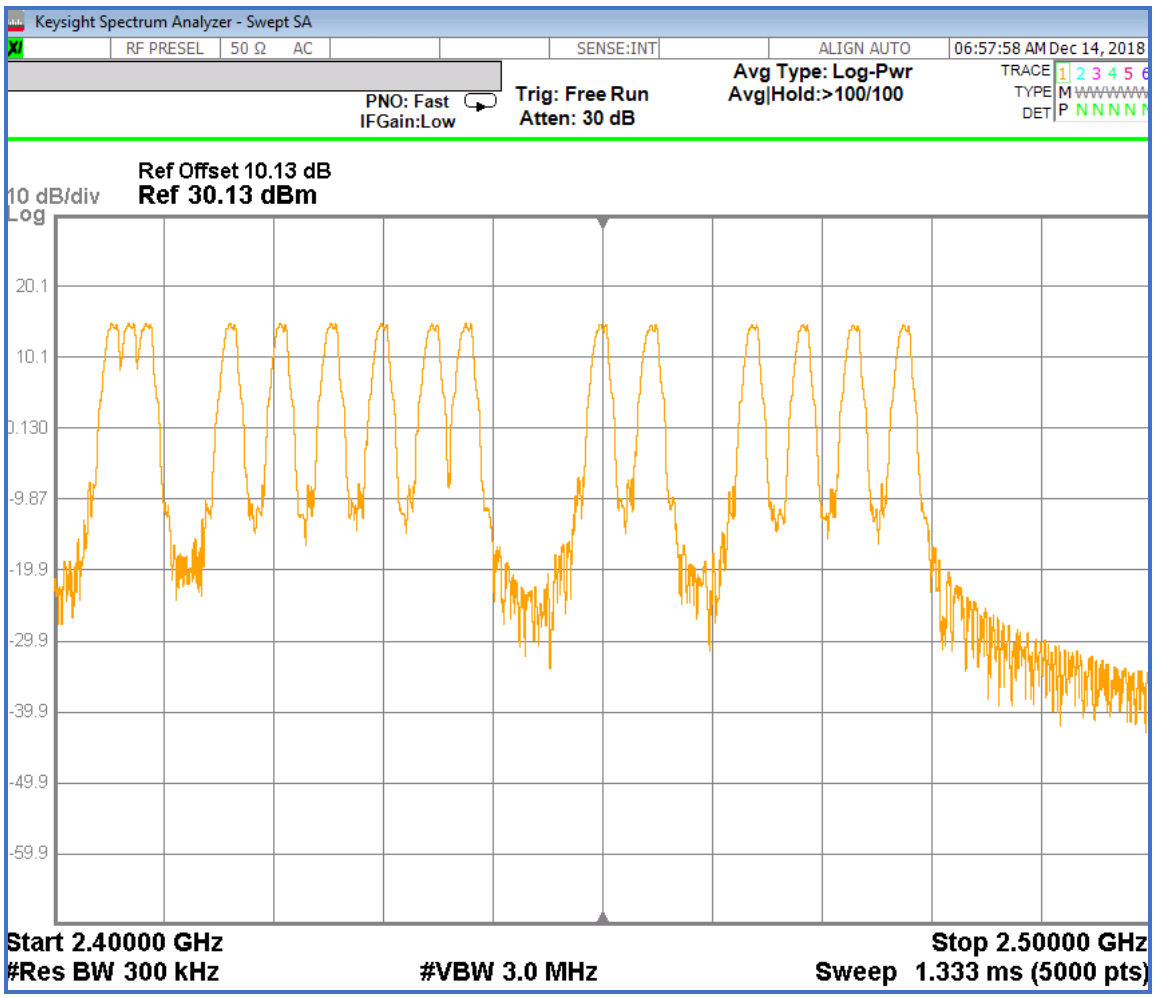
Screen Capture from the spectrum analyzer:



2.7.6 Hopping Channel Data: (Ginseng-2 Radio)

There are 15 hopping channels

Screen Capture from the spectrum analyzer:



2.8 Time of Occupancy (Dwell Time)

Test Lab: Electronics Test Centre, Airdrie	**EUT: Soulplay**
Test Personnel: Imran Akram **Bushra Muharram**	**Standard: FCC PART 15.247**
Date: 2018-12-14 (20.6°C,14.2% RH)	**Basic Standard: ANSI C63.10: 20013**

EUT status: Compliant

Specification: FCC Part 15.247 [a, 1(iii)]

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

2.8.1 Test Guidance: ANSI 63.10 Clause 7.8.4 / FCC DA-00-0705

This measurement is performed with the EUT frequency hopping function active.

The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation. The loss from the cable and the attenuator were added on the analyzer as gain offset setting there by allowing direct measurements, without the need for any further corrections.

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:	
Span	zero span, centered on a hopping channel
RBW	The RBW shall be ≤ Channel spacing and where possible RBW should be set >> 1/T, where T is the expected dwell time per channel
VBW	≥RBW
Sweep	as necessary to capture the entire dwell time per hopping channel
Detector function	peak
Trace	max hold
Allow the trace to stabilize. If possible, use the marker-delta function to determine the dwell time.	

2.8.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

2.8.3 Test Equipment

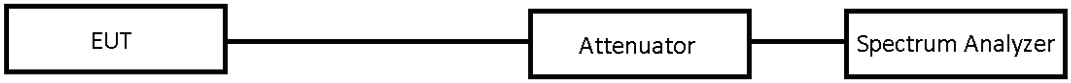
Testing was performed with the following equipment:

Equipment	Manufacturer	Model #	Asset #	Cal. Date	Interval	Cal. Due
EMI receiver	Agilent	N9038A	6130	2018-05-02	1 year	2019-05-02
Temp/Humidity	Extech	42270	5892	2019-04-13	1 year	2019-04-13
Attenuator	FairView Microwave	SA18N5WA-10	6886	2018-11-23	1 year	2019-11-23
DC Blocker	MCL	BLK-89-S+	-	2018-01-15	1 year	2019-01-15
CE Cable (50cm length)	Huber+Suhner	Enviroflex 400	-	2018-01-15	1 year	2019-01-15

2.8.4 Test Sample Verification, Configuration & Modifications

The EUT was operating in normal mode. The EUT met the requirements without modification.

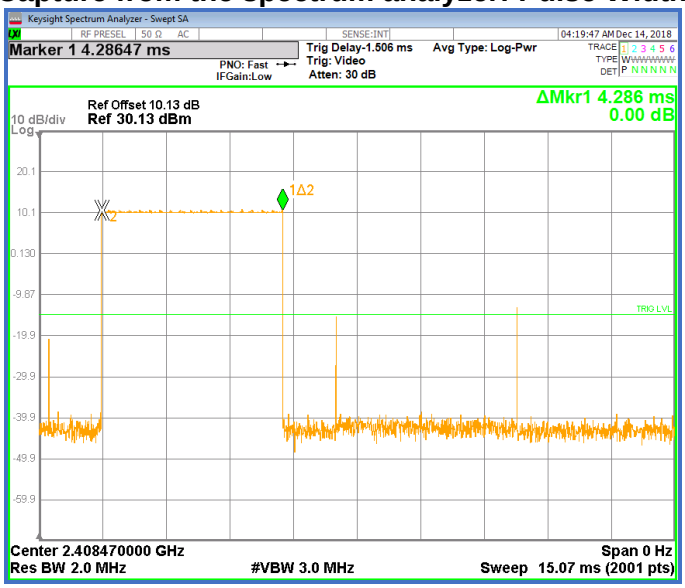
EUT configuration for Dwell Time testing:



2.8.5 Dwell Time Data: (Ginseng-1 Radio)

Pulse Width (ms)	Number of Pulses	Total Dwell Time (ms)	Measuring Period (.4s x # of hop CH)	Limit (sec)
4.286	73	312.878	6 Sec	.4 (400ms)

Screen Capture from the spectrum analyzer: Pulse Width

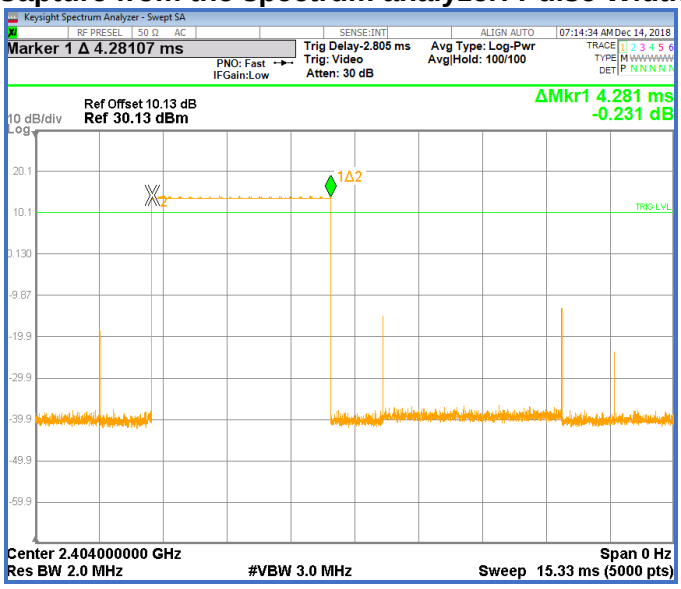


Screen Capture from the spectrum analyzer: Period - 6 Sec

2.8.6 Dwell Time Data (Ginseng-2 Radio)

Pulse Width (ms)	Number of Pulses	Total Dwell Time (ms)	Measuring Period (.4s x # of hop CH)	Limit (sec)
4.281	73	312.513	6 Sec	.4 (400ms)

Screen Capture from the spectrum analyzer: Pulse Width



Screen Capture from the spectrum analyzer: Period - 6 Sec

2.9 EUT Positioning Assessment

Test Lab: Electronics Test Centre, Airdrie	**EUT: Soulplay**
Test Personnel:	**Standard: FCC PART 15.247**
	Basic Standard: ANSI C63.4-2014
Date:	

N/A - Fixed Wall Mount

Comments: EUT will be oriented in one fix position.

Specification: ANSI C63.4-2014, Clause 6.3.2.1

Portable, small, lightweight, or modular devices that may be handheld, worn on the body, or placed on a table during operation shall be positioned on a non-conducting platform, the top of which is 80 cm above the reference ground plane. The preferred area occupied by the EUT arrangement is 1 m by 1.5 m, but it may be larger or smaller to accommodate various sized EUTs (see Figure 6, Figure 7, and Figure 9). For testing purposes, ceiling- and wall-mounted devices also shall be positioned on a tabletop (see also 6.3.4 and 6.3.5). In making any tests involving handheld, body-worn, or ceiling-mounted equipment, it is essential to recognize that the measured levels may be dependent on the orientation (attitude) of the three orthogonal axes of the EUT. Thus, exploratory tests as specified in 8.3.1 shall be carried out for various axes orientations to determine the attitude having maximum or near-maximum emission level.

2.10 Radiated Spurious Emissions (Ginseng1 & Ginseng2 Tx Mode)

Test Lab: Electronics Test Centre, Airdrie	**EUT: Soulplay**
Test Personnel: Imran Akram **Bushra Muharram**	**Standard: FCC PART 15.247** **Basic Standard: ANSI C63.10-2013**
Date: 2018-12-11/13/14/18 (20.6°C,14.2 % RH)	

EUT status: Compliant

Specification: FCC PART 15.247(d)

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 §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Restricted Bands of Operation:

MHz	MHz	MHz	MHz	MHz	GHz	GHz
0.0900000 – 0.1100000	8.2910000 - 8.2940000	16.804250 - 16.804750	162.01250 - 167.17000 *	1660.0000 – 1710.0000	3.6000000 – 4.4000000	14.470000 – 14.500000
0.4950000 - 0.5050000 *	8.3620000 - 8.3660000	25.500000 - 25.670000	167.72000 - 173.20000 *	1718.8000 – 1722.2000	4.5000000 – 5.1500000	15.350000 – 16.200000
2.1735000 - 2.1905000	8.3762500 - 8.3867500	37.500000 - 38.250000	240.00000 – 285.00000	2200.0000 – 2300.0000	5.3500000 – 5.4600000	17.700000 – 21.400000
4.1250000 - 4.1280000	8.4142500 - 8.4147500	73.000000 - 74.600000	322.00000 - 335.40000	2310.0000 – 2390.0000	7.2500000 – 7.7500000	22.010000 – 23.120000
4.1772500 - 4.1777500	12.290000 - 12.293000	74.800000 - 75.200000	399.90000 – 410.00000	2483.5000 – 2500.0000 *	8.0250000 – 8.5000000	23.600000 – 24.000000
4.2072500 - 4.2077500	12.519750 - 12.520250	108.00000 - 121.94000 **	608.00000 – 614.00000	2655.0000 – 2900.0000	9.0000000 – 9.2000000	31.200000 – 31.800000
5.6770000 - 5.6830000	12.576750 - 12.577250	123.00000 - 138.00000 **	960.00000 – 1240.0000 ***	3260..0000 – 3267.0000	9.3000000 – 9.5000000	36.430000 – 36.500000
6.2150000 - 6.2180000	13.360000 - 13.410000	149.90000 - 150.05000 *	1300.0000 – 1427.0000 ***	3332.0000 – 3339.0000	10.600000 – 12.700000	Above 38.600000
6.2677500 - 6.2682500	16.420000 - 16.423000	156.52475- 156.52525	1435.0000 – 1626.5000	3345.8000 – 3358.0000	13.250000 – 13.400000	
6.3117500 - 6.3122500	16.694750 - 16.695250	156.70000 - 156.90000	1645.5000 – 1646.5000	3500.0000 – 3600.0000 ****		

* US only ** Canada 108 – 138 MHz *** Canada 960 – 1427 MHz **** Canada only

2.10.1 Test Guidance: ANSI C63.10-2013, Clause 13.4.2

From 9 kHz to 150 kHz (resolution bandwidth of 200 Hz) and from 150 kHz to 30 MHz (resolution bandwidth 9 kHz) measurements are performed with a loop antenna (as per KDB 460108).

From 30 MHz to 1000 MHz, measurements are performed with a broadband biconilog antenna and a resolution bandwidth of 120 kHz.

Above 1000 MHz, measurements are performed with a DRG Horn antenna or a Standard Gain horn, and a resolution bandwidth of 1 MHz The EUT is raised to 150 cm above the ground plane, and the area between the EUT and the antenna mast is covered with RF absorbent material.

The scan is performed at discrete increments of turntable azimuth and antenna height, which are selected in accordance with the applicable standard in order to assure capture of frequencies of interest. Optimization is performed based on the scan data.

Frequencies having peak emissions within 10dB of the limits are optimized. The EUT is rotated in azimuth over 360 degrees and the direction of maximum emission is noted.

Antenna height is varied from 1 – 4 meters at this azimuth to obtain the maximum emission. Then the maximum level is measured with the appropriate detector and recorded. Up to 1 GHz, measurements are performed with a Quasi-Peak detector. Above 1 GHz, measurements are recorded with Peak and/or Average detectors, as applicable.

2.10.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

2.10.3 Test Equipment

Testing was performed with the following equipment:

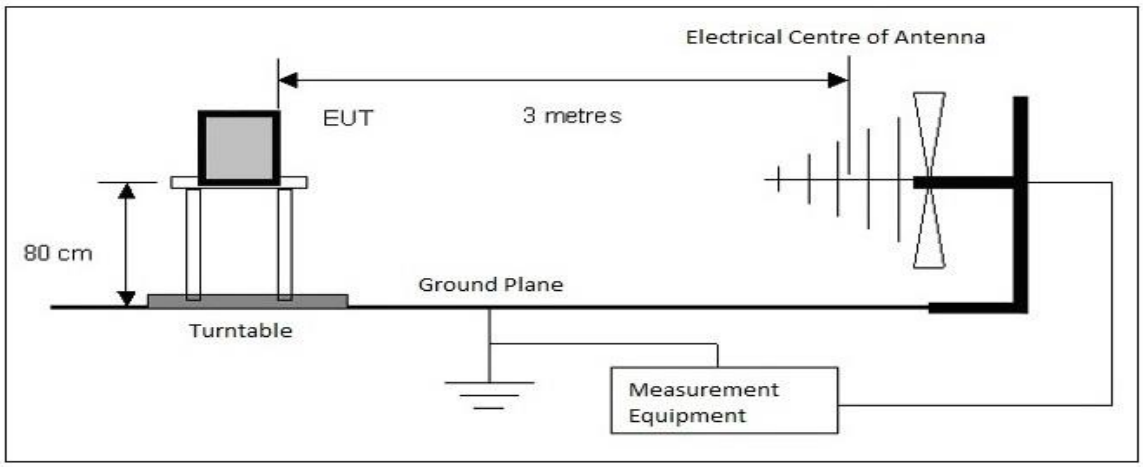
Equipment	Manufacturer	Model #	Asset #	Calibration Date	Interval	Calibration Due
EMC Software	UL	Ver. 9.5	ETC-SW-EMC 2.1	N/A		
EMI receiver	Agilent	N9038A	6130	2018-05-02	1yr	2019-05-02
Loop Antenna	EMCO	6502	10868	2017-03-29	2yr	2019-03-29
Biconilog Antenna	ARA	LPB-2520/A	4318	2018-09-19	2yr	2020-09-19
DRG Horn	EMCO	3115	19357	2018-09-12	2yr	2020-09-12
Standard Horn	QuinStar Technology Inc.	QWH-KPRS00	6163	2018-09-13	2yr	2020-09-13
Humidity/Temp Logger	Extech Ins. Corp.	42270	5892	2018-04-13	1yr	2019-04-13
Low Noise Amplifier (1 – 18 GHz)	MITEQ	JS43-01001800-21-5P	4354	2018-01-03	1yr	2019-01-03
Low Noise Amplifier (18 – 26 GHz)	MITEQ	JS44-01002650-33-3P	6163	2018-01-03	1yr	2019-01-03
Pre-Amplifier (30 – 1300 MHz)	hp	8447D	9291	2018-01-03	1yr	2019-01-03
RE Cable below 1GHz	Insulated Wire Inc.	KPS-1501A-3600-KPA-01102006	4419	2018-01-03	1yr	2019-01-03
RE Cable Above 1 GHz	A.H. System Inc.	SAC-26G-8.23	6187	2018-01-03	1yr	2019-01-03

2.10.4 Test Sample Verification, Configuration & Modifications

The EUT was set to a selected channel with test-specific software. The output was modulated as in normal operation.

The EUT met the requirements without modification.

Test setup diagram for Radiated Spurious Emissions testing (below 1GHz):



Above 1GHz, the EUT is raised using a low permittivity material (polystyrene) to a height of 1.5m.

2.10.5 Radiated Emissions Data:

The emissions data are presented in tabular form, showing turntable azimuth, antenna height and polarization, the uncorrected spectrum analyzer reading, the correction factors applied, the net result, the value of the limit at the frequency investigated, and the Delta between the result and the limit.

Meter Reading in dBμV + Antenna Factor in dB/m + Gain/Loss Factor in dB = Corrected Field Strength in dbμV/m.

Delta = Field Strength - Limit

Notes:

- When a preamp is used, the resulting gain is compensated, producing a negative value for the Cable Loss.
- Measurements reported are the result of adjusting the turntable azimuth and antenna height to obtain the maximum EUT emission. This may produce a different reading than the plot trace. The plot is a Peak Hold function obtained at discrete increments of height and azimuth, while the reported measurement is obtained with the appropriate Quasi Peak or Average detector after the height and azimuth have been adjusted for maximum emission.
- Preliminary scans were performed for all channels in Transmit modes. The MID band channel 2441 MHz for Ginseng Radio 2 and upper channel 2477 MHz for Ginseng Radio 1 were selected as the worst-case condition for detailed examination. Both radio Ginseng1 and Ginseng2 are transmitting simultaneously.
- In Transmit mode, the EUT was assessed up to 25.0 GHz.

Negative values for Delta indicate compliance.

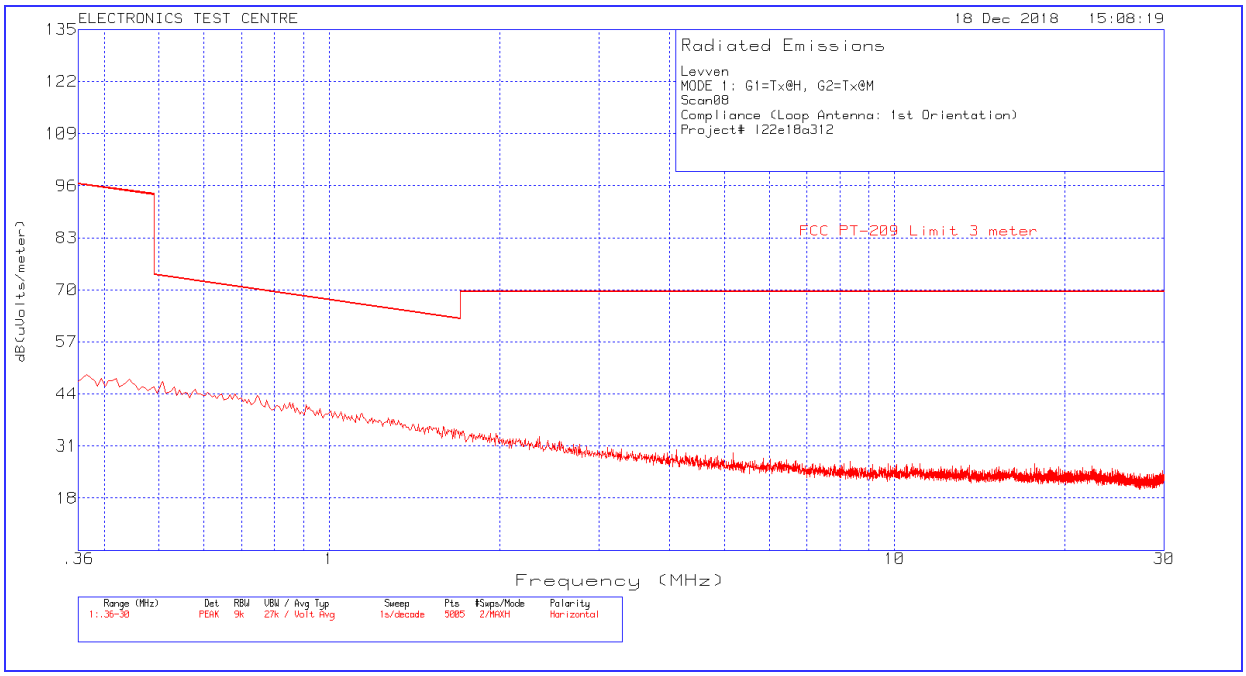
Freq. Marker	Freq. [GHz]	Raw reading [dBµv]	Det	Antenna Factor [dB/m]	Pre amp Gain [dB]	Corrected Reading [dBµv/m]	FCC 15.209 Limit [dBµv/m]	Delta [dB]	Azimuth [Deg]	Height [cm]	Polarization
1	*4.8814	56.05	PK	33	-31.7	57.35	74	-16.65	80	325	Horizontal
1	*4.8814	49.91	Av	33	-31.7	51.21	54	-2.79	80	325	Horizontal
2	*4.9543	53.93	PK	33.2	-31.6	55.53	74	-18.47	298	348	Horizontal
2	*4.9543	47.46	Av	33.2	-31.6	49.06	54	-4.94	298	348	Horizontal
3	*7.3213	42.97	PK	36.4	-27.8	51.57	74	-22.43	79	382	Horizontal
3	*7.3213	36.33	Av	36.4	-27.8	44.93	54	-9.07	79	382	Horizontal
4	*7.4278	38.94	PK	36.5	-28.1	47.34	74	-26.66	293	385	Horizontal
4	*7.4278	30.52	Av	36.5	-28.1	38.92	54	-15.08	293	385	Horizontal
5	9.7632	43.94	PK	37.9	-26.9	54.94	74	-19.06	98	307	Horizontal
5	9.7632	35.14	Av	37.9	-26.9	46.14	54	-7.86	98	307	Horizontal
6	9.909	41.27	PK	38	-26.6	52.67	74	-21.33	200	192	Horizontal
6	9.909	32.37	Av	38	-26.6	43.77	54	-10.23	200	192	Horizontal
7	*12.2041	40.02	PK	39.3	-25.2	54.12	74	-19.88	313	183	Horizontal
7	*12.2041	32.17	Av	39.3	-25.2	46.27	54	-7.73	313	183	Horizontal
8	*4.8814	54.2	PK	33	-31.7	55.5	74	-18.5	297	232	Vertical
8	*4.8814	47.81	Av	33	-31.7	49.11	54	-4.89	297	232	Vertical
9	*4.9543	53.38	PK	33.2	-31.6	54.98	74	-19.02	133	114	Vertical
9	*4.9543	46.91	Av	33.2	-31.6	48.51	54	-5.49	133	114	Vertical
10	*7.3223	48.57	PK	36.4	-27.8	57.17	74	-16.83	109	102	Vertical
10	*7.3223	43.57	Av	36.4	-27.8	52.17	54	-1.83	109	102	Vertical
11	*7.4307	44.01	PK	36.5	-28.1	52.41	74	-21.59	344	216	Vertical
11	*7.4307	35.21	Av	36.5	-28.1	43.61	54	-10.37	344	216	Vertical
12	9.7632	41.63	PK	37.9	-26.9	52.63	74	-21.37	265	222	Vertical
12	9.7632	32.29	Av	37.9	-26.9	43.29	54	-10.71	265	222	Vertical
13	9.909	41.11	PK	38	-26.6	52.51	74	-21.49	266	309	Vertical
13	9.909	32.42	Av	38	-26.6	43.82	54	-10.18	266	309	Vertical
14	*12.2041	35.3	PK	39.3	-25.2	49.4	74	-24.6	148	180	Vertical
14	*12.2041	25.62	Av	39.3	-25.2	39.72	54	-14.28	148	180	Vertical

*** Restricted Band**

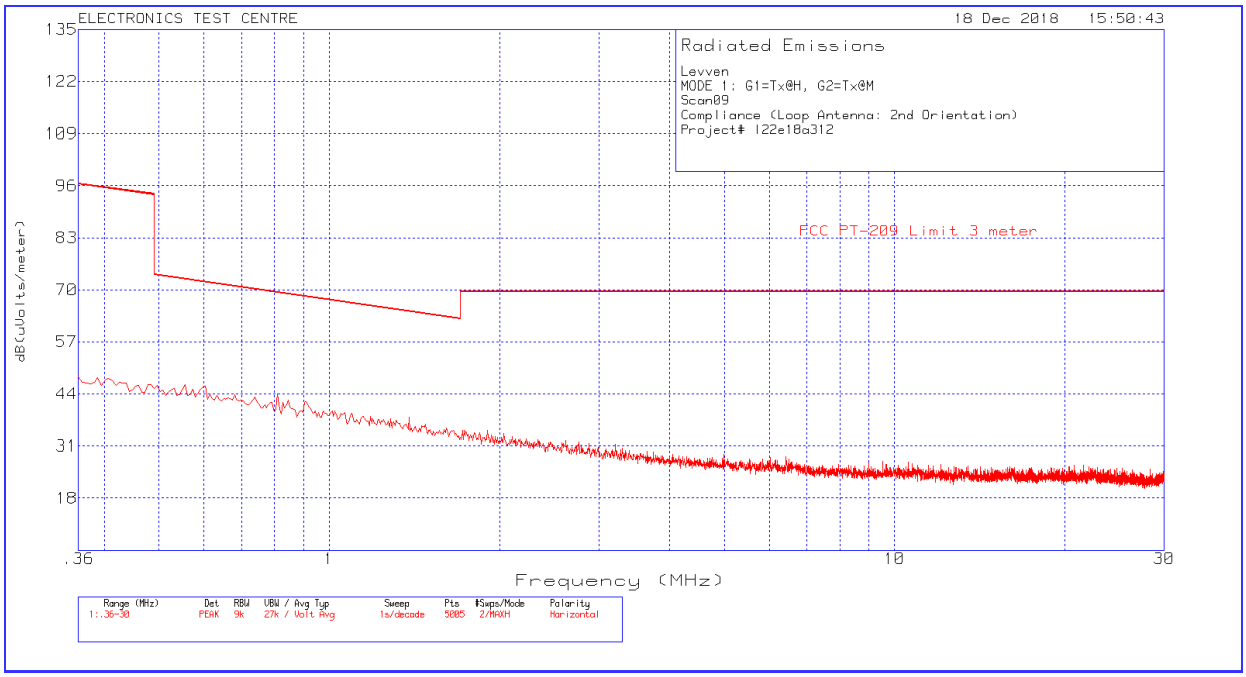
PK - Peak detector

Av - Average detector

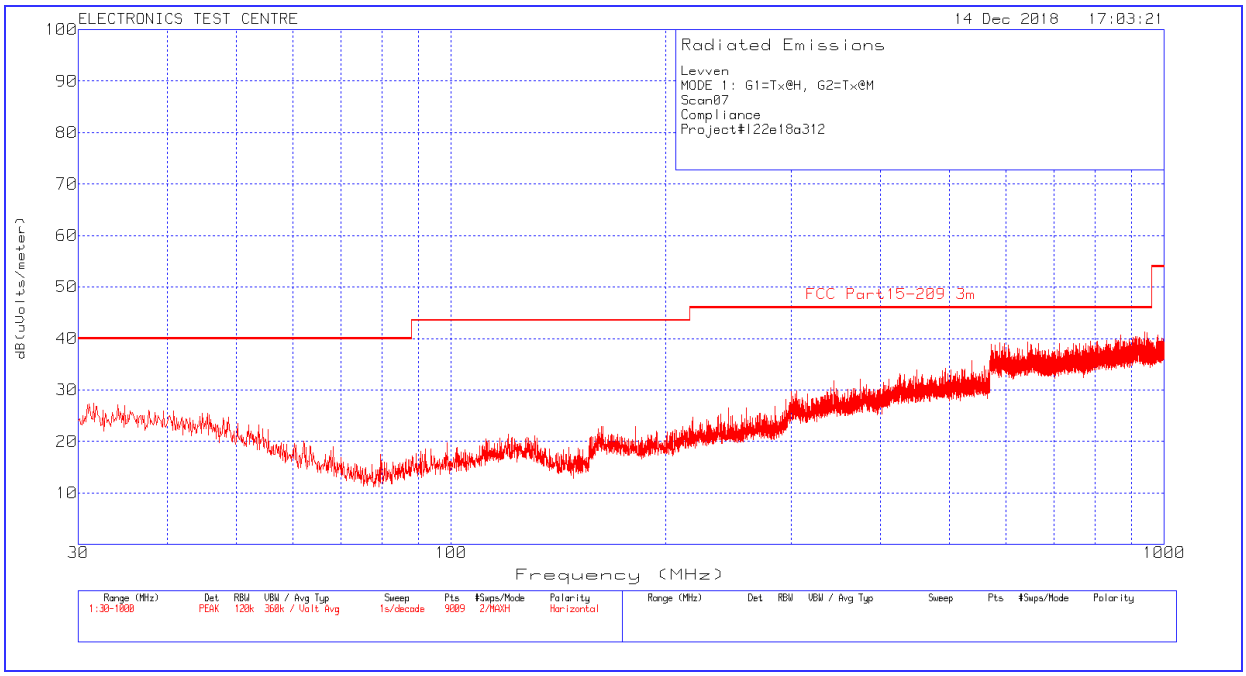
Plot of Radiated Emissions: Measuring Antenna Parallel



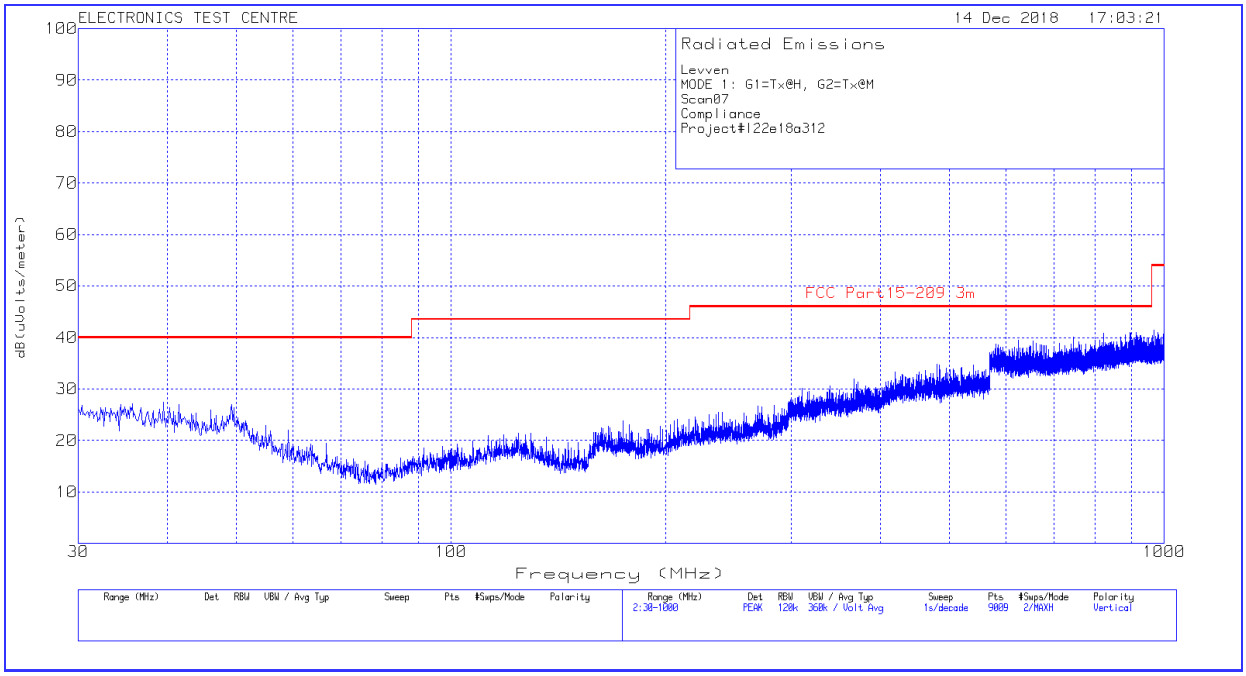
Plot of Radiated Emissions: Measuring Antenna Perpendicular



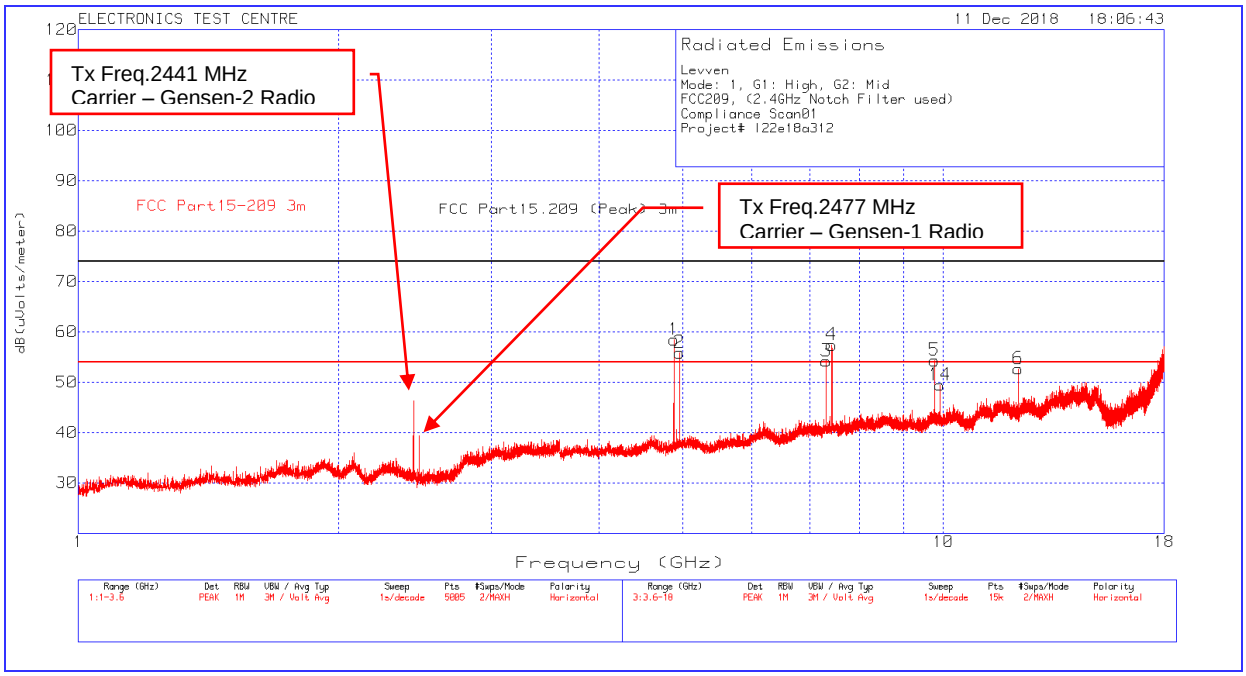
Plot of Radiated Emissions: Horizontal polarization



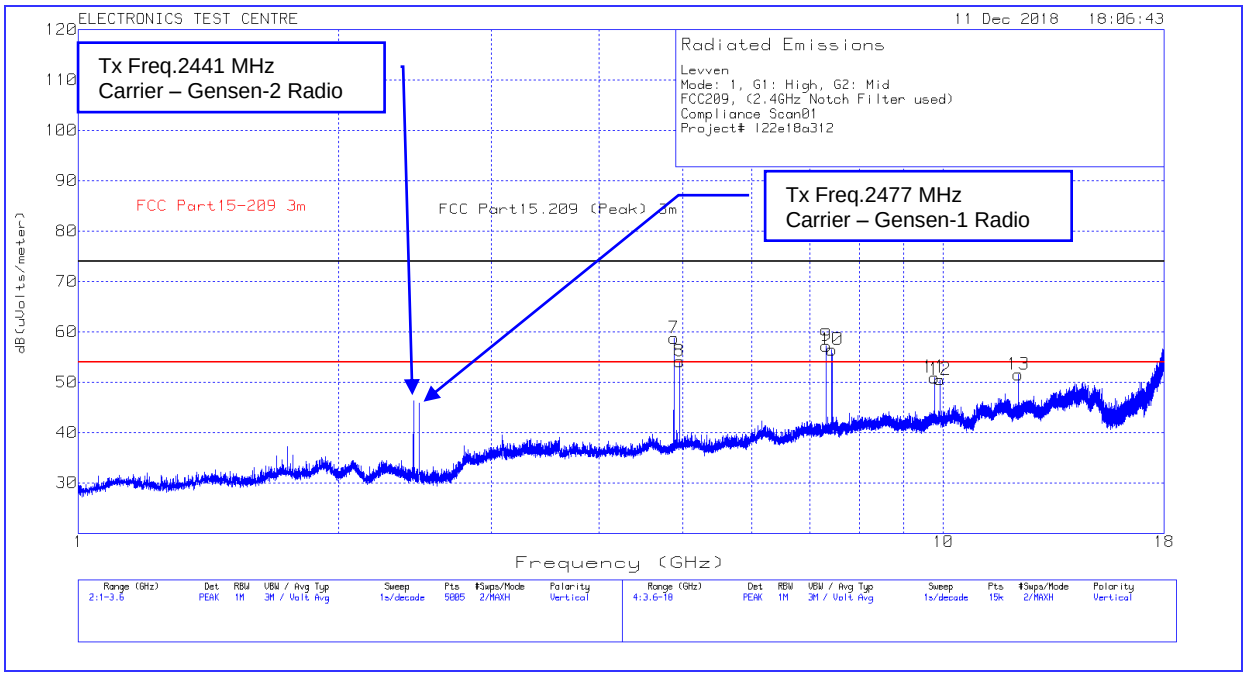
Plot of Radiated Emissions: Vertical polarization



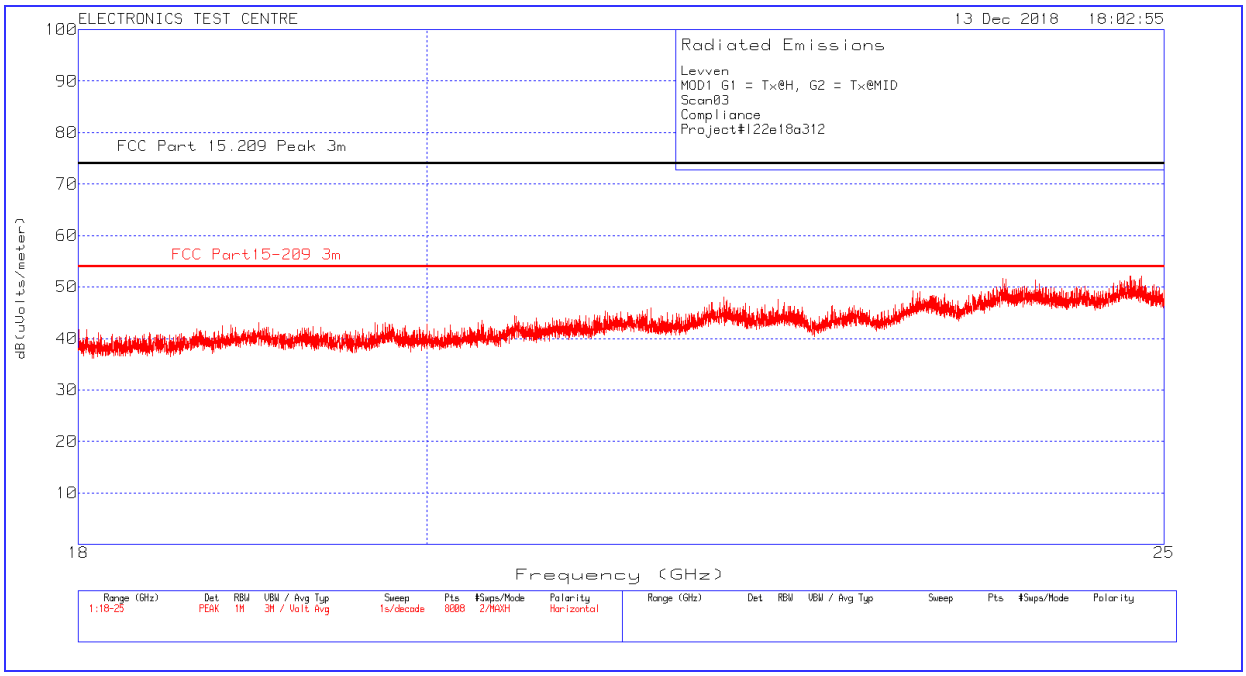
Plot of Radiated Emissions: Horizontal polarization



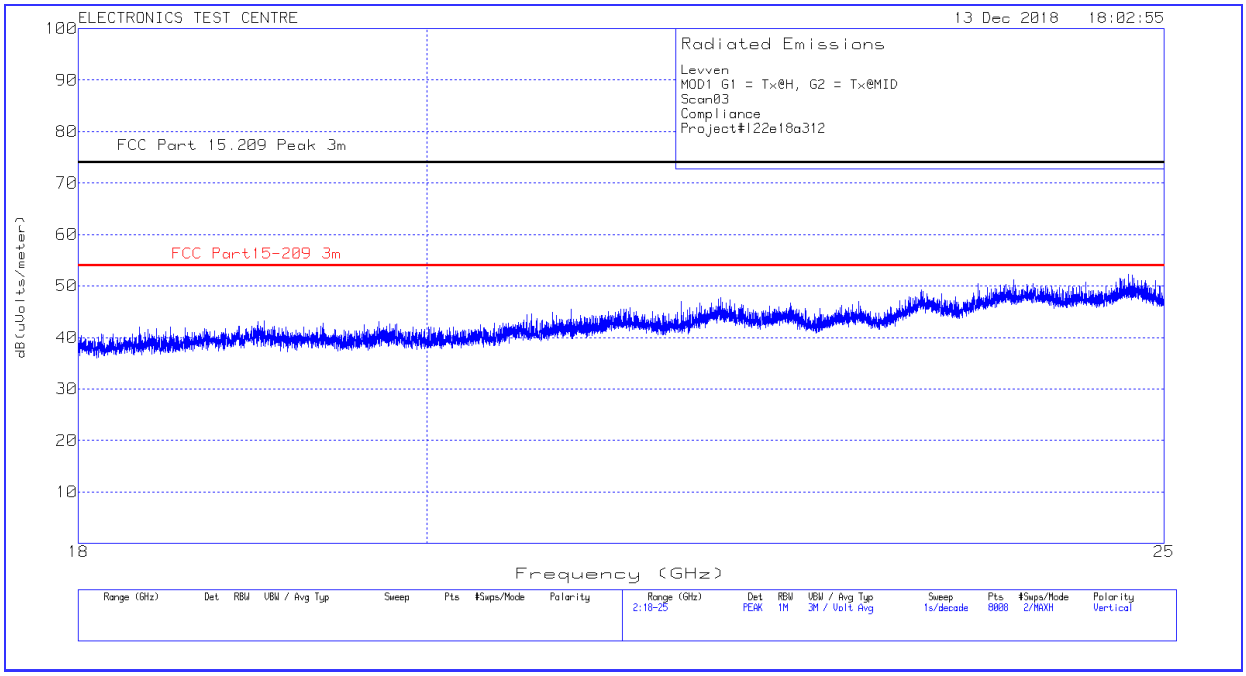
Plot of Radiated Emissions: Vertical polarization



Plot of Radiated Emissions: Horizontal polarization



Plot of Radiated Emissions: Vertical polarization



2.11 RF Exposure

Test Lab: Electronics Test Centre, Airdrie	**EUT: Soulplay**
Test Personnel:	**Standard: FCC PART 15.247**
Date:	

EUT status: Exempt

Compliant: RF exposure assessment to be provided in a separate Exhibit.

3.0 TEST FACILITY

3.1 Location

The Soulplay was tested for emissions at the Electronics Test Centre laboratory located in Airdrie, Alberta, Canada. The Radio Frequency Anechoic Chamber (RFAC), identified as Chamber 1, has a usable working space measuring 10.6 m long x 7.3 m wide x 6.5 m high.

Measurements taken at this site are accepted by Industry Canada as evidence of conformity per registration file # 2046A. This site is also listed with the FCC under Registration Number CA2046.

The floor, walls and ceiling consist of annealed steel panels. The walls and ceiling are covered with ferrite tile, augmented by RF absorbant foam material on the end wall nearest the turntable, and on the adjacent walls and the ceiling. The chamber floor supports a 15 cm high internal floor, constructed of annealed steel panels, that forms the ground plane, and is bonded to the chamber walls.

The 3-m diameter turntable is flush-mounted with the floor. A sub-floor cable-way is provided to route cables between the turntable pit and EUT support equipment located in the Control Room. Cables reach the EUT through an opening in the centre of the turntable.

Test instrumentation and EUT support equipment is located in the Control Room, consisting of two shielded vestibules joined together at the side of the main room. Cables are routed through bulkhead panels between the rooms and the test chamber as required. Power feeds are routed into the main room and vestibules through line filters providing at least 100 dB of attenuation between 10 kHz and 10 GHz.

Either floor mounted or table-top equipment can be tested at this facility.

3.2 Grounding Plan

The Soulplay was placed at the center of the test chamber turntable on top of an 80-cm high polystyrene foam table. The EUT was grounded according to Levven Automation specifications.

3.3 Power Supply

All EUT power was supplied by filtered 120VAC / 60Hz main.

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