



CERTIFICATION TEST REPORT

Report Number. : R12924905-E5

Applicant : Bose Corporation
100 The Mountain
Framingham, MA 01701, USA

Model : 431389RF

FCC ID : A94431389RF

IC : 3232A-431389RF

EUT Description : BT/BLE RF module

Test Standard(s) : FCC 47 CFR PART 15 SUBPART C
ISED RSS-247 ISSUE 2
ISED RSS-GEN ISSUE 5

Date Of Issue:

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NVLAP Lab code: 200246-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
--	--	Initial Issue	--
V2	2019-10-05	Updated model and FCC/IC IDs	Niklas Haydon

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Bose Corporation
100 The Mountain
Framingham, MA 01701, USA

EUT DESCRIPTION: BT/BLE RF module

MODEL: 431389RF

SERIAL NUMBER: Rev 1-1, Rev 1-6, Rev 1-17

DATE TESTED: 2019-08-13 to 2019-09-23

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Complies
ISED RSS-247 Issue 2	Complies
ISED RSS-GEN Issue 5	Complies

UL LLC tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

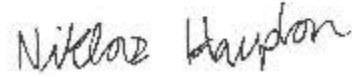
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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013, KDB 558074 D01 15.247 Meas Guidance v05r02, RSS-GEN Issue 5, and RSS-247 Issue 2.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 12 Laboratory Drive, Research Triangle Park, North Carolina, USA and 2800 Perimeter Park Dr., Suite B, Morrisville, North Carolina, USA. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

12 Laboratory Dr.		2800 Perimeter Park Dr., Suite B	
ISED Site Code: 2180C			
☐	Chamber A RTP	☒	North Chamber
☐	Chamber C RTP	☒	South Chamber

The above test sites and facilities are covered under FCC Test Firm Registration # 703469. Chambers above are covered under Industry Canada company address and respective code.

UL LLC (RTP) is accredited by NVLAP, Laboratory Code 200246-0

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)
 $36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} = 28.9 \text{ dBuV/m}$

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.
 $36.5 \text{ dBuV} + 0 \text{ dB} + 10.1 \text{ dB} + 0 \text{ dB} = 46.6 \text{ dBuV}$

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Radio Frequency (Spectrum Analyzer)	141.2 Hz
Occupied Channel Bandwidth	2.00%
RF output power, conducted	1.3 dB (PK) 0.45 dB (AV)
Power Spectral Density, conducted	2.47 dB
Unwanted Emissions, conducted	2.50 dB
All emissions, radiated	4.88 dB
Temperature	2.26°C
Humidity	6.79%
DC Supply voltages	1.70%
Time	3.39%

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. EUT DESCRIPTION

The EUT is a BT/BLE RF module.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2402 - 2480	Basic GFSK	10.19	10.45
2402 - 2480	Enhanced DQPSK	9.65	9.23
2402 - 2480	Enhanced 8PSK	10.09	10.21

Note: GFSK, DQPSK, 8PSK average Power are all investigated, The GFSK & 8PSK Power are the worst case. Testing is based on these modes to showing compliance.

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an external dipole antenna, with a maximum gain of 0 dBi.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was 0.3.001

The EUT driver software installed in the host support equipment during testing was 100.0.0.0

The test utility software, BlueTest3, used during testing was 3.1.4

5.5. WORST-CASE CONFIGURATION AND MODE

Radiated emissions below 1GHz, above 18GHz, and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

Band edge and radiated emissions between 1GHz and 18GHz were performed with the EUT set to transmit at the highest power on low, middle and high channels.

The fundamental of the EUT was investigated in three orthogonal orientations X,Y,Z, it was determined that Y orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y orientation.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List			
Description	Manufacturer	Model	Serial Number
Laptop	Lenovo	T450s	RTP0416PC0BHFP3
Laptop Charger	Lenovo	ADLX65NDC2A	11S45N0255Z1ZSH953B8X2

I/O CABLES

I/O Cable List						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	USB	1	USB Type C	USB	<2	None

TEST SETUP

The EUT is connected to a test laptop during the tests. Test software exercised the radio card.

SETUP DIAGRAMS

Please refer to R12924905-EP1 for setup diagrams.

6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - North Chamber)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	1-18 GHz				
AT0067	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2019-03-22	2020-03-22
	Gain-Loss Chains				
N-SAC03	Gain-loss string: 1-18GHz	Various	Various	2019-03-15	2020-03-15
	Receiver & Software				
SA0026	Spectrum Analyzer	Agilent	N9030A	2019-03-19	2020-03-19
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
	Additional Equipment used				
s/n 181474341	Environmental Meter	Fisher Scientific	15-077-963	2018-07-27	2020-07-27

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - South Chamber)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	0.009-30MHz	(Loop Ant.)			
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2019-08-08	2020-08-08
	30-1000 MHz				
AT0074	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2019-07-16	2020-07-16
	1-18 GHz				
AT0072	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2019-04-22	2020-04-22
	18-40 GHz				
AT0076	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2018-11-08	2019-11-08
	Gain-Loss Chains				
S-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2019-05-02	2020-05-02
S-SAC02	Gain-loss string: 25-1000MHz	Various	Various	2019-05-02	2020-05-02
S-SAC03	Gain-loss string: 1-18GHz	Various	Various	2019-03-13	2020-03-13
S-SAC04	Gain-loss string: 18-40GHz	Various	Various	2018-09-30	2019-09-30
	Receiver & Software				
SA0025	Spectrum Analyzer	Agilent	N9030A	2019-02-28	2020-02-28
SA0027 (18-40GHz RSE)	Spectrum Analyzer	Agilent	N9030A	2019-05-15	2020-05-15
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
	Additional Equipment used				
s/n 181474409	Environmental Meter	Fisher Scientific	15-077-963	2018-07-27	2020-07-27

Test Equipment Used – Line Conducted Emissions Voltage (Morrisville – Conducted 1)

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
CBL087	Coax cable, RG223, N-male to BNC-male, 20-ft.	Pasternack	PE3W06143-240	2019-05-29	2020-05-29
s/n 161016511	Environmental Meter	Fisher Scientific	14-650-118	2018-09-04	2020-09-04
LISN003	LISN, 50-ohm/50-uH, 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50-25-2-01-550V	2019-08-19	2020-08-19
75141 (PRE0101521)	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2019-08-21	2020-08-22
TL001	Transient Limiter, 0.009-30MHz	Com-Power	LIT-930A	2019-05-29	2020-05-29
PS215	AC Power Source	Elgar	CW2501M (s/n 1523A02397)	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA

Test Equipment Used - Wireless Conducted Measurement Equipment (Morrisville – Conducted 1 & 2)

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
72822 (PRE0100902)	Spectrum Analyzer	Agilent Technologies	E4446A	2018-11-19	2019-11-19
SA0021	Spectrum Analyzer	Keysight Technologies	N9030A	2019-05-16	2020-05-16
SA0027	Spectrum Analyzer	Keysight Technologies	N9030A	2019-05-15	2020-05-15
PWM005	RF Power Meter	Keysight Technologies	N1911A	2019-07-08	2020-07-08
PWS005	Peak and Avg Power Sensor, 50MHz to 6GHz	Keysight Technologies	E9323A	2019-05-06	2020-07-08
76023 (EC0225)	Temp/Humid Chamber	Cincinnati Sub-Zero	ZPH-8-3.5-SCT/AC	2019-06-14	2020-06-14
SN 181474341	Environmental Meter	Fisher Scientific	15-077-963	2018-07-27	2020-07-27
76021	DC Regulated Power Supply	CircuitSpecialists.Com	CSI3005X5	N/A	N/A

7. MEASUREMENT METHODS

On Time and Duty Cycle: ANSI C63.10-2013 Section 11.6

Occupied BW (20dB): ANSI C63.10-2013 Section 6.9.2

Occupied BW (99%): ANSI C63.10-2013 Section 6.9.3

Carrier Frequency Separation: ANSI C63.10-2013 Section 7.8.2

Number of Hopping Frequencies: ANSI C63.10-2013 Section 7.8.3

Time of Occupancy (Dwell Time): ANSI C63.10-2013 Section 7.8.4

Peak Output Power: ANSI C63.10-2013 Section 7.8.5

Out-of-Band Emissions in non-restricted band: ANSI C63.10-2013 Section 7.8.6, 7.8.8. & 6.10.4

Out-of-band emissions in restricted bands: ANSI C63.10-2013 Section 6.3-6.6 & 6.10.5

AC Line Conducted Emissions: ANSI C63.10-2013 Section 6.2

8. ANTENNA PORT TEST RESULTS

8.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

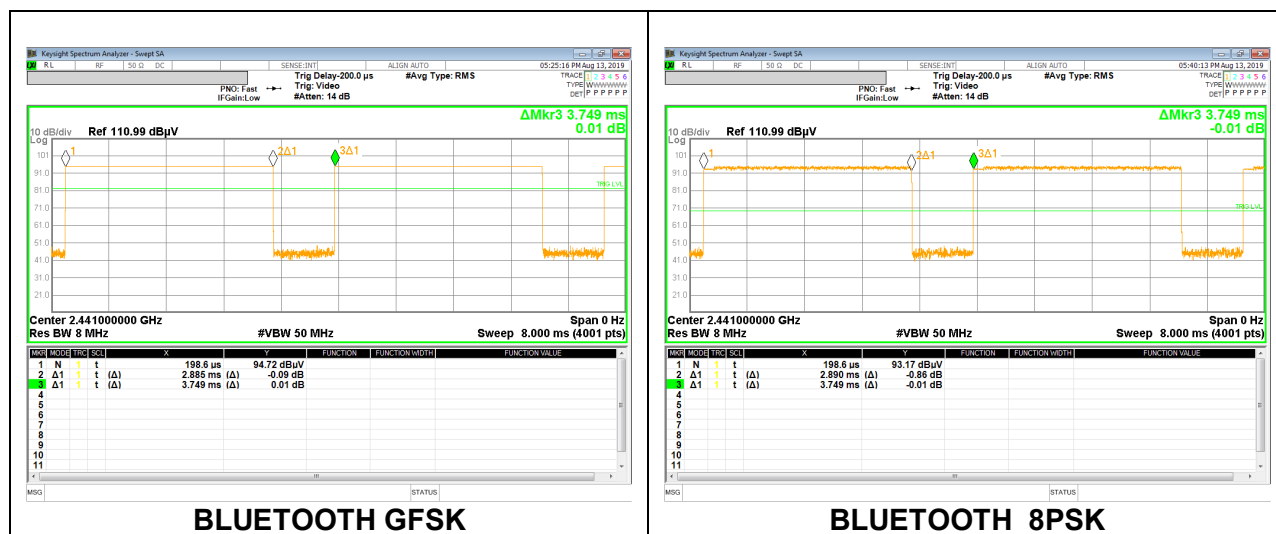
PROCEDURE

ANSI C63.10, Section 11.6 : Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/T Minimum VBW (kHz)
Bluetooth GFSK	2.885	3.749	0.770	77.0%	1.14	0.347
Bluetooth 8PSK	2.890	3.749	0.771	77.1%	1.13	0.346

DUTY CYCLE PLOTS



Tested by: 17051

8.2. 20 dB AND 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

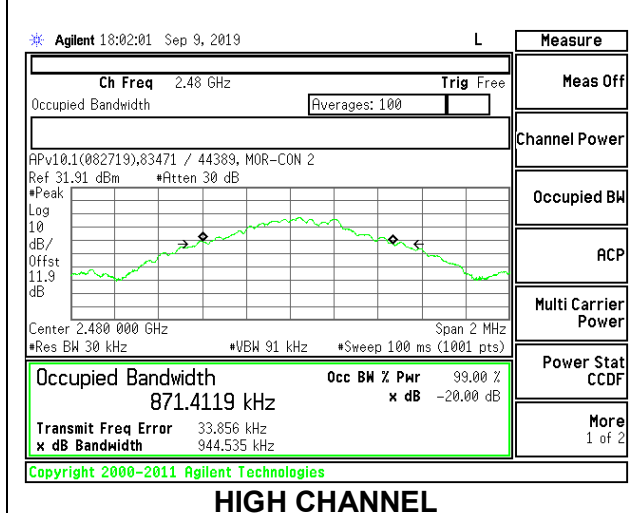
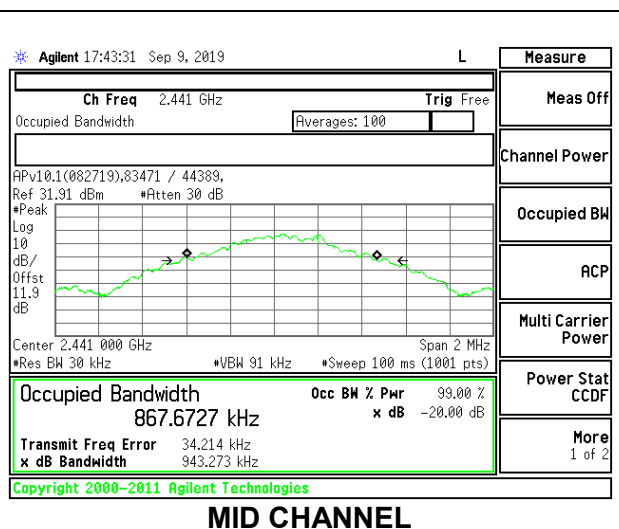
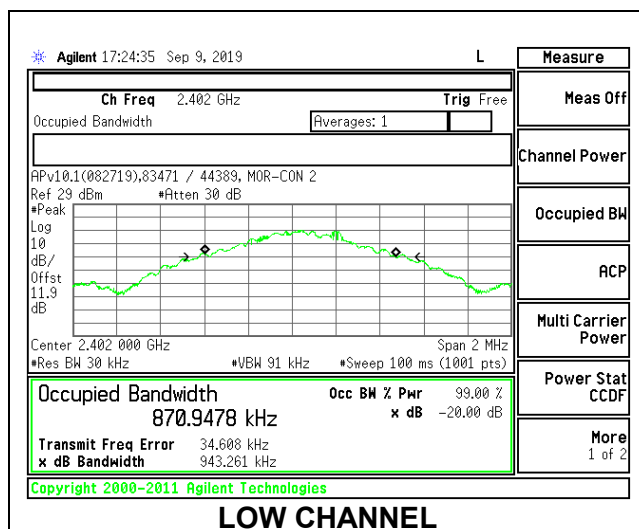
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 1-5% of the 20 dB bandwidth and the 99% Occupied Bandwidth. The VBW is set to $\geq 3 \times$ RBW. The sweep time is coupled.

RESULTS

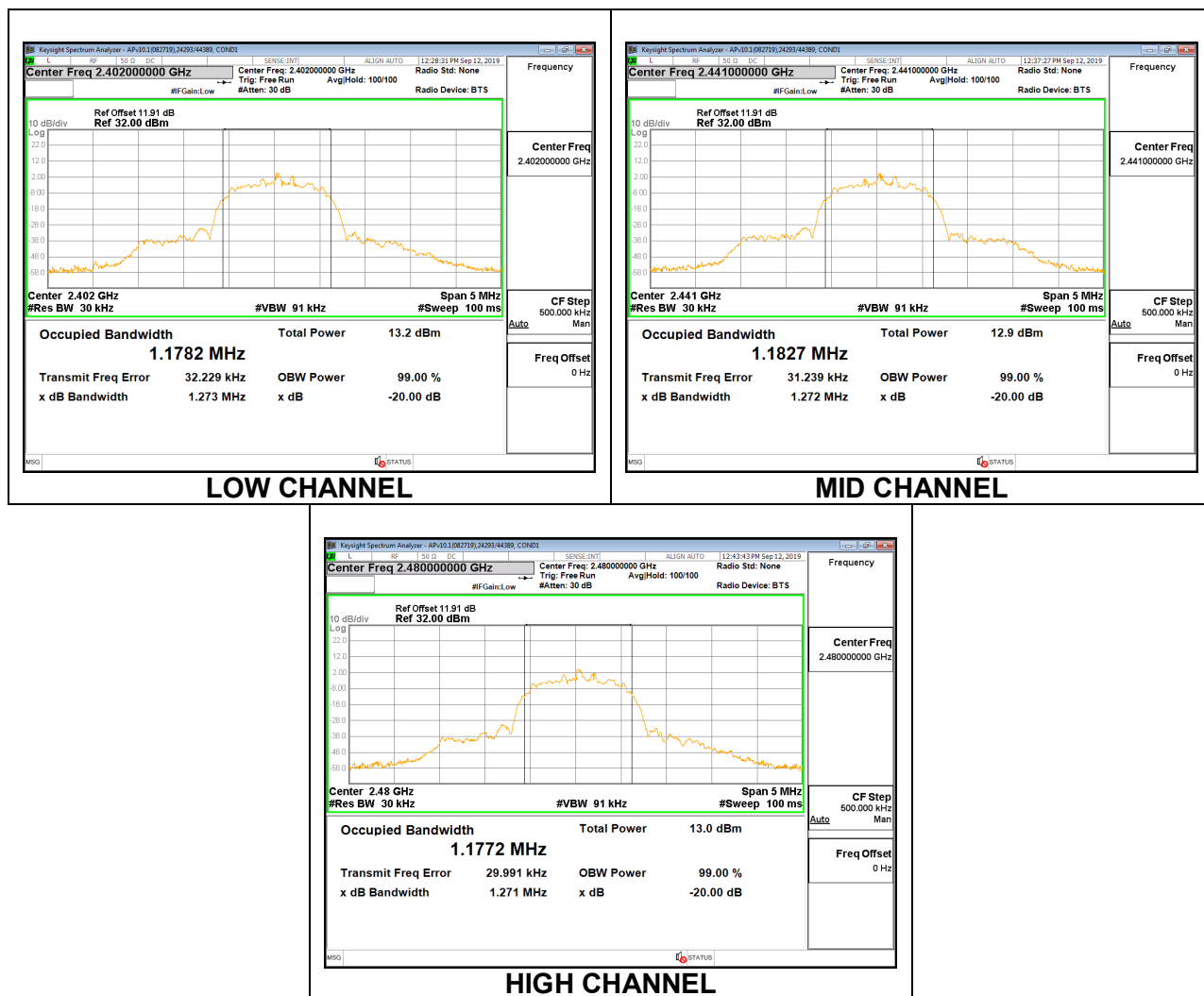
8.2.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	0.943	0.871
Mid	2441	0.943	0.868
High	2480	0.945	0.871



8.2.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	1.273	1.178
Mid	2441	1.272	1.183
High	2480	1.271	1.177



8.3. HOPPING FREQUENCY SEPARATION

LIMITS

FCC §15.247 (a) (1)
RSS-247 (5.1) (b)

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

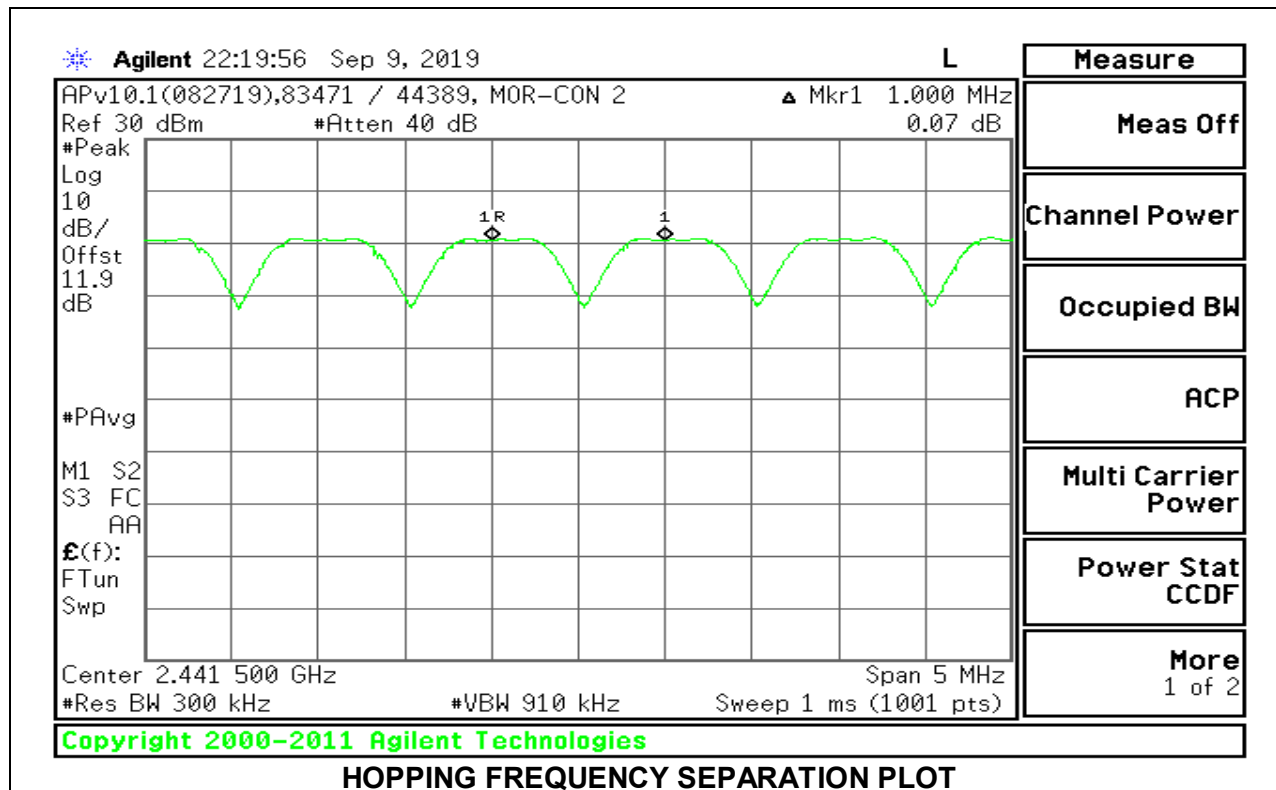
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

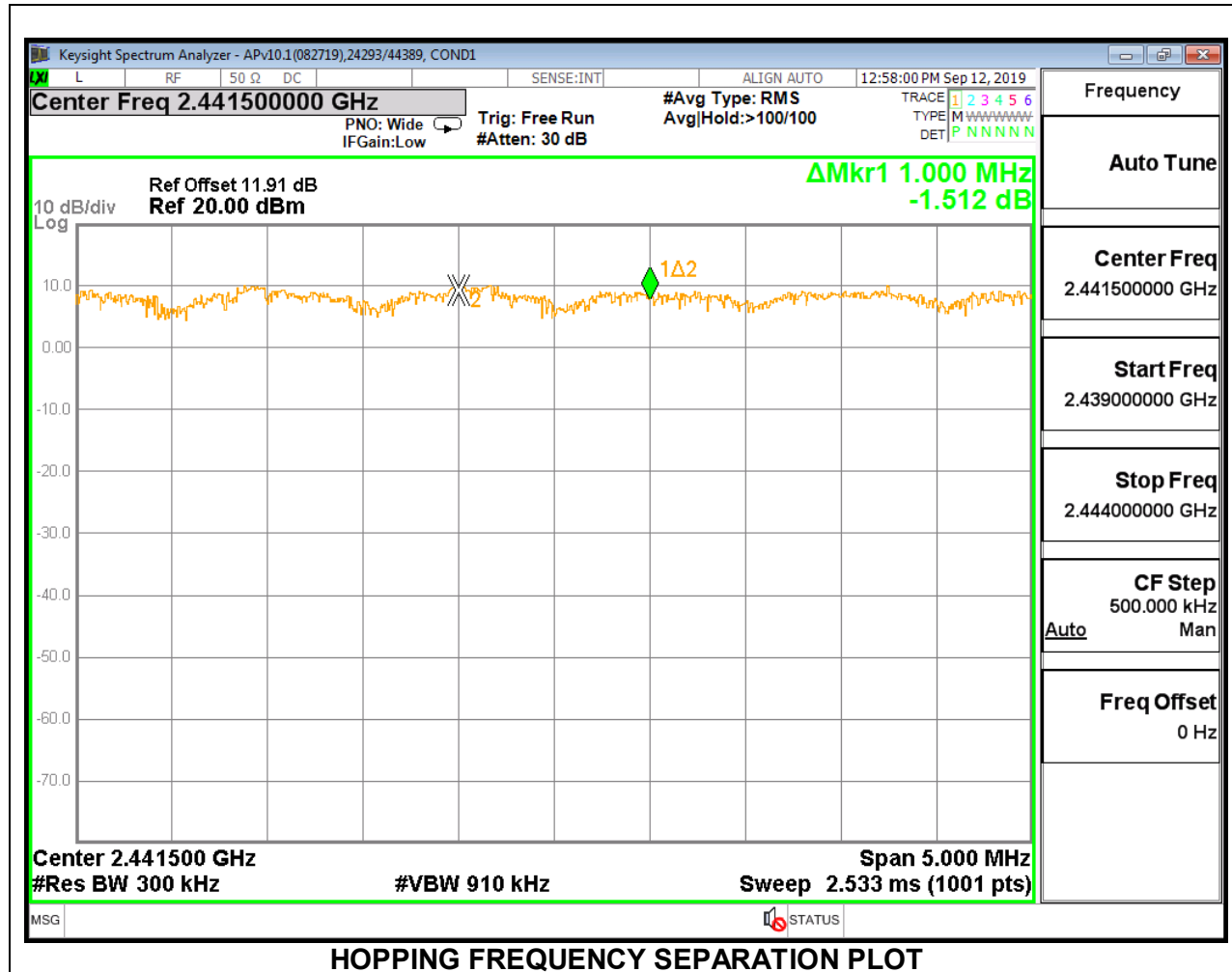
The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz (approx. 30% of channel spacing) and the VBW is set to $VBW \geq RBW$. The sweep time is coupled.

RESULTS

8.3.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION



8.3.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION



Note – 8DPSK is separated by 1 MHz. This meets the min. $\frac{2}{3}$ of 20 dB BW or $\frac{2}{3}(1.273 \text{ MHz}) = 849 \text{ kHz}$ when less than 125mW power. Refer to Section 8.6 for Output Power results.

8.4. NUMBER OF HOPPING CHANNELS

LIMITS

FCC §15.247 (a) (1) (iii)
RSS-247 (5.1) (d)

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

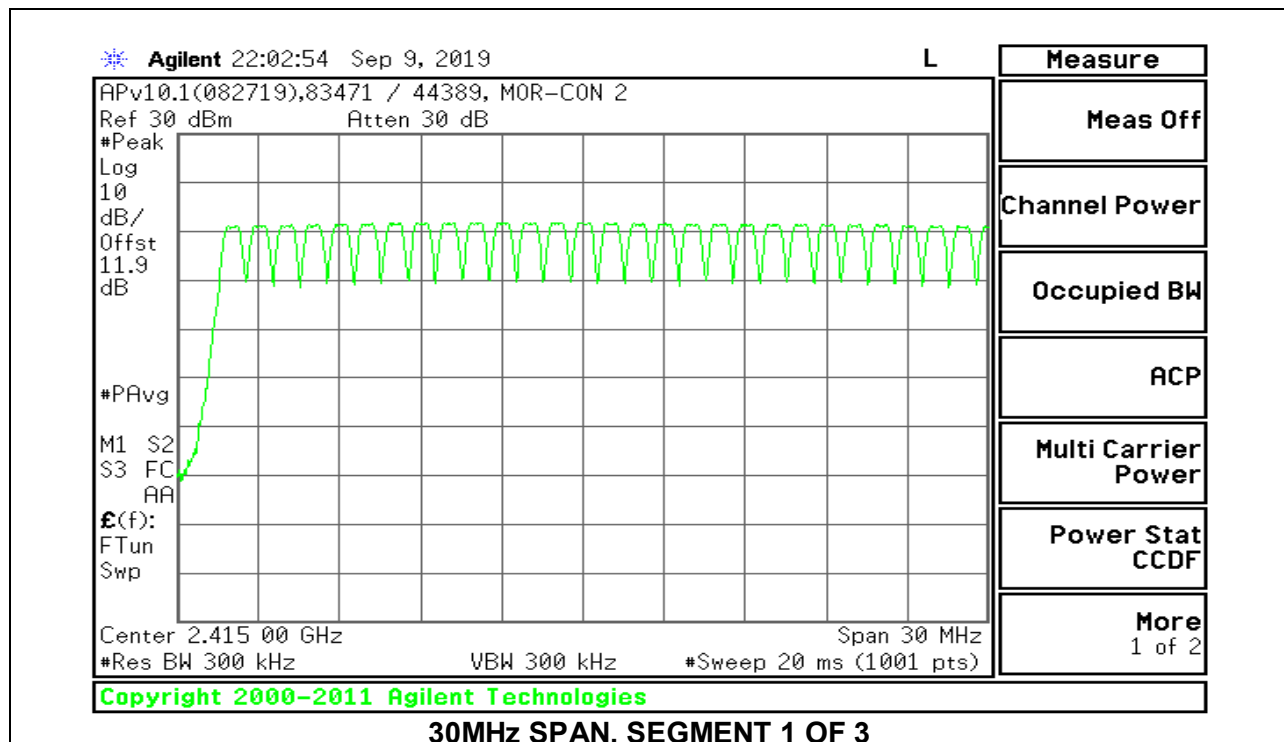
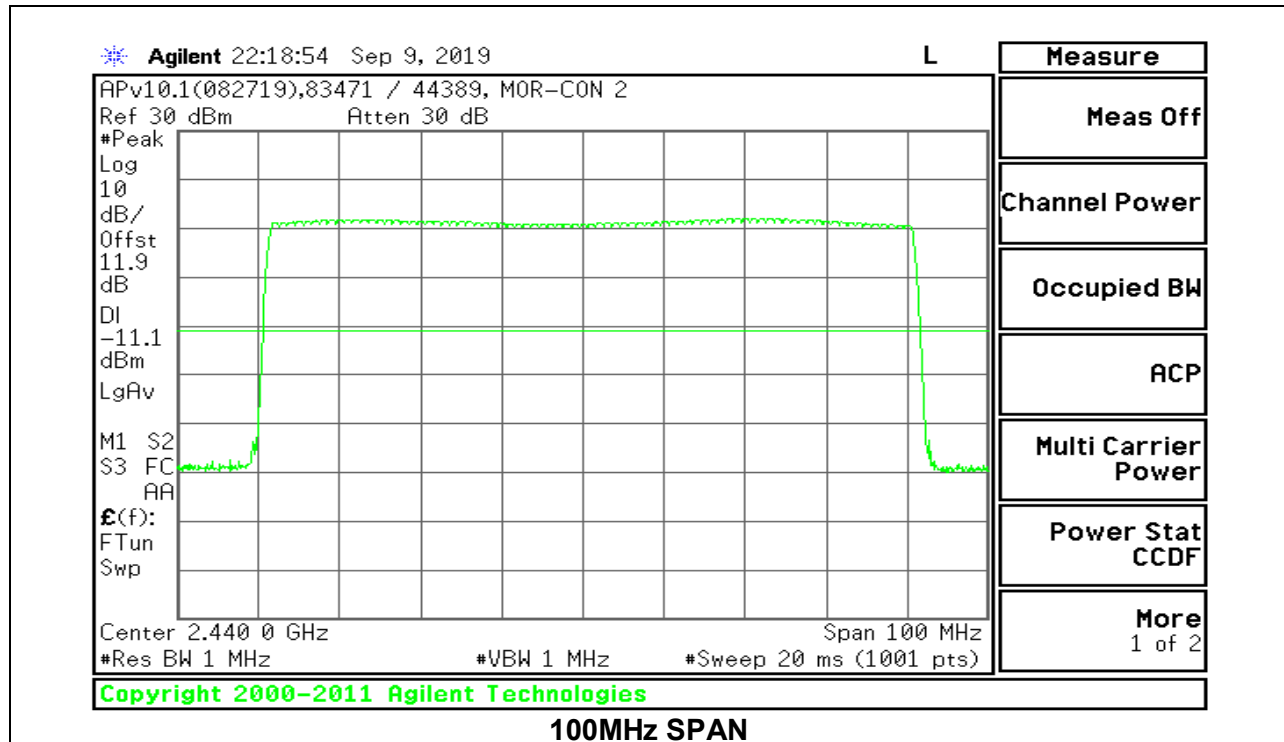
TEST PROCEDURE

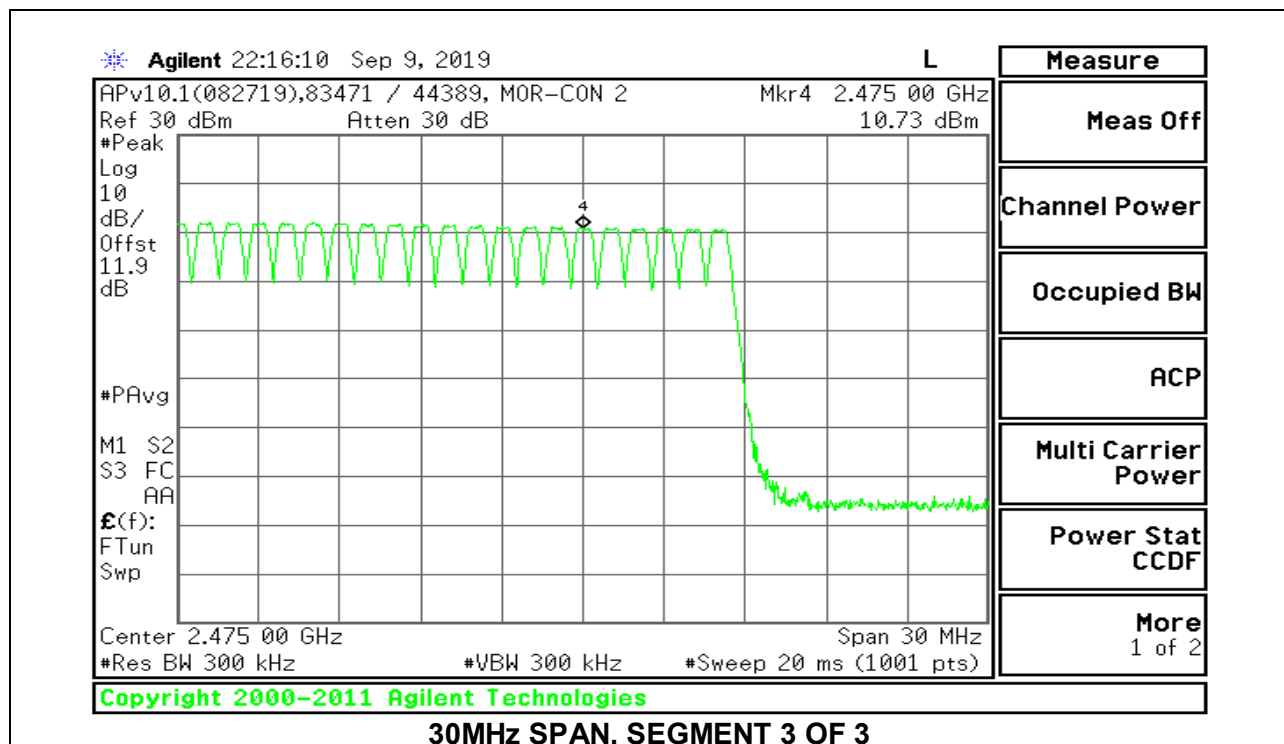
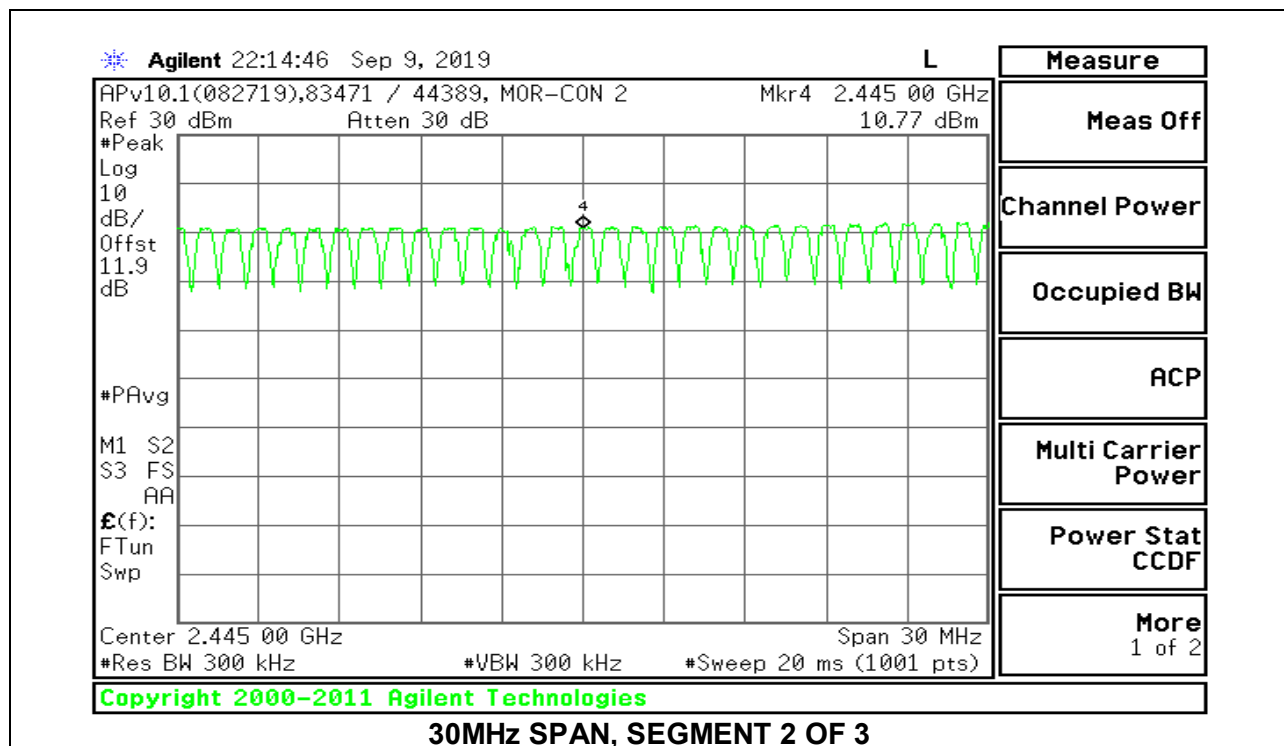
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps for visibility of the entire span. Then, smaller spans are set to more clearly identify the channels. The RBW is set to 30% of the channel spacing (approx. 300kHz). The analyzer is set to Max Hold.

RESULTS

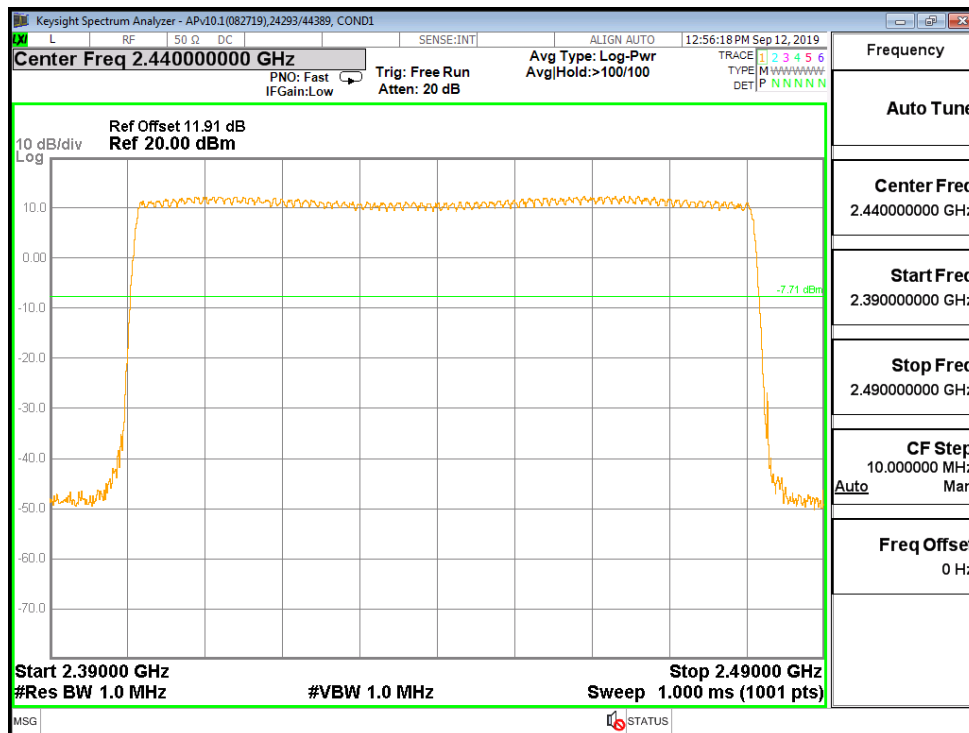
Normal Mode: All Channels Observed

8.4.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

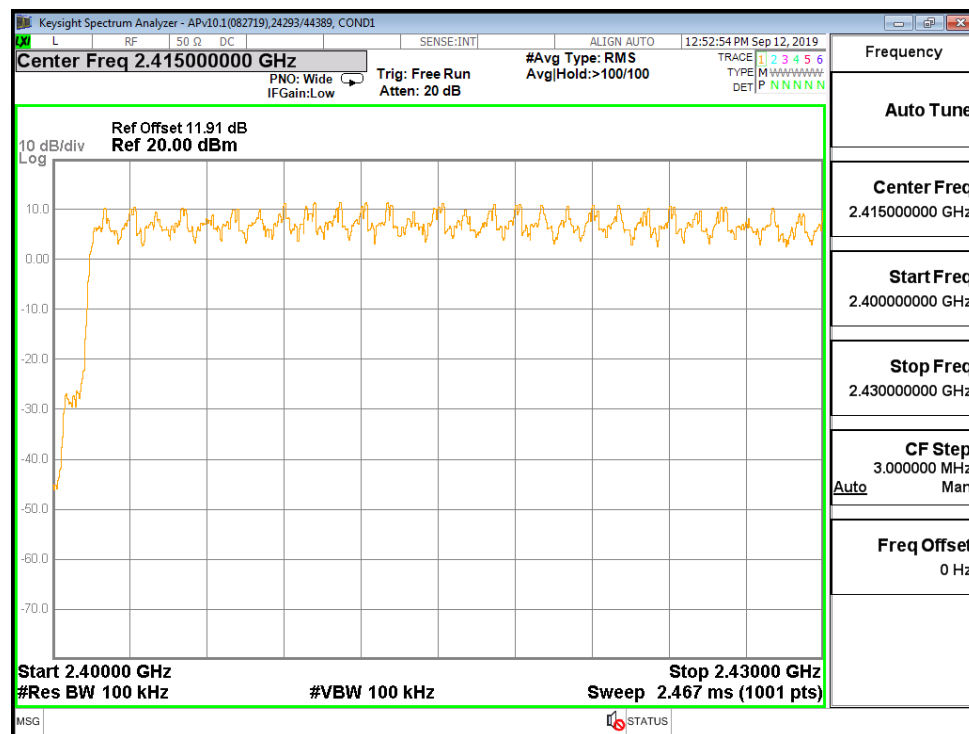




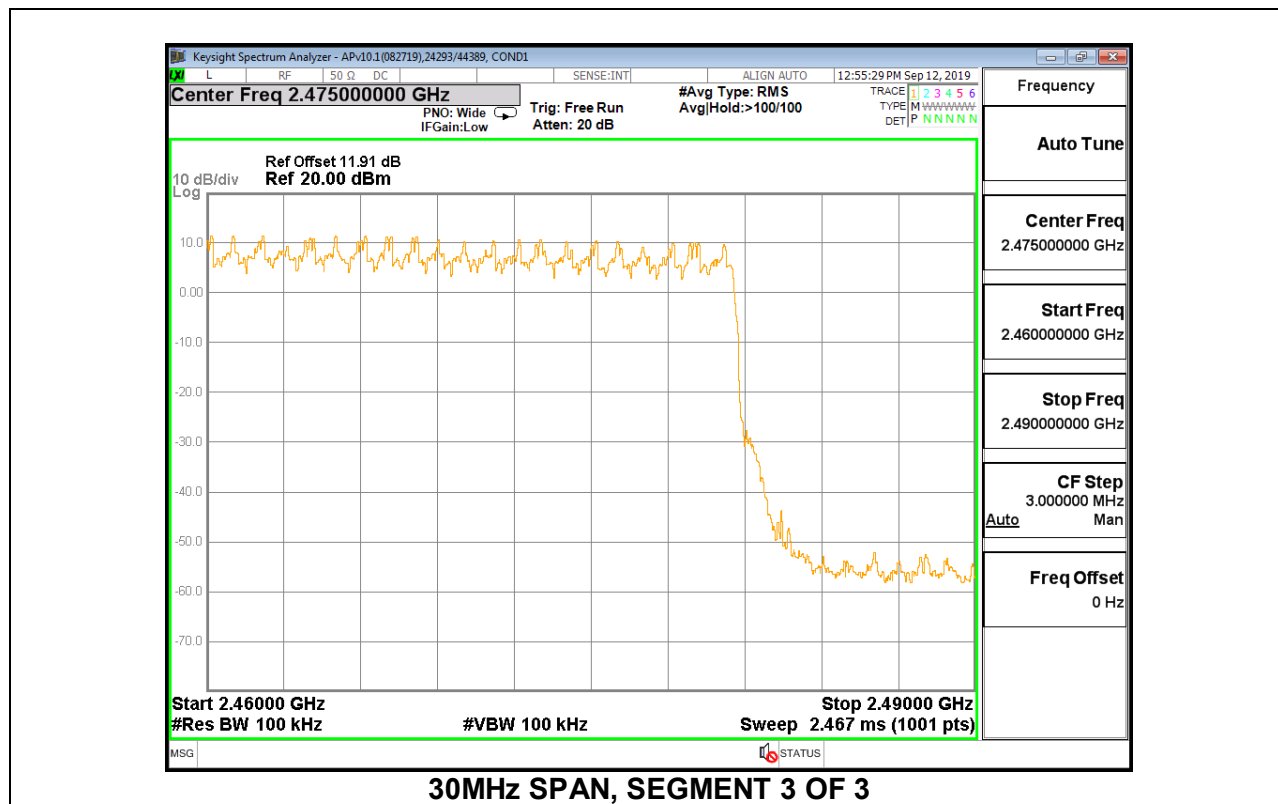
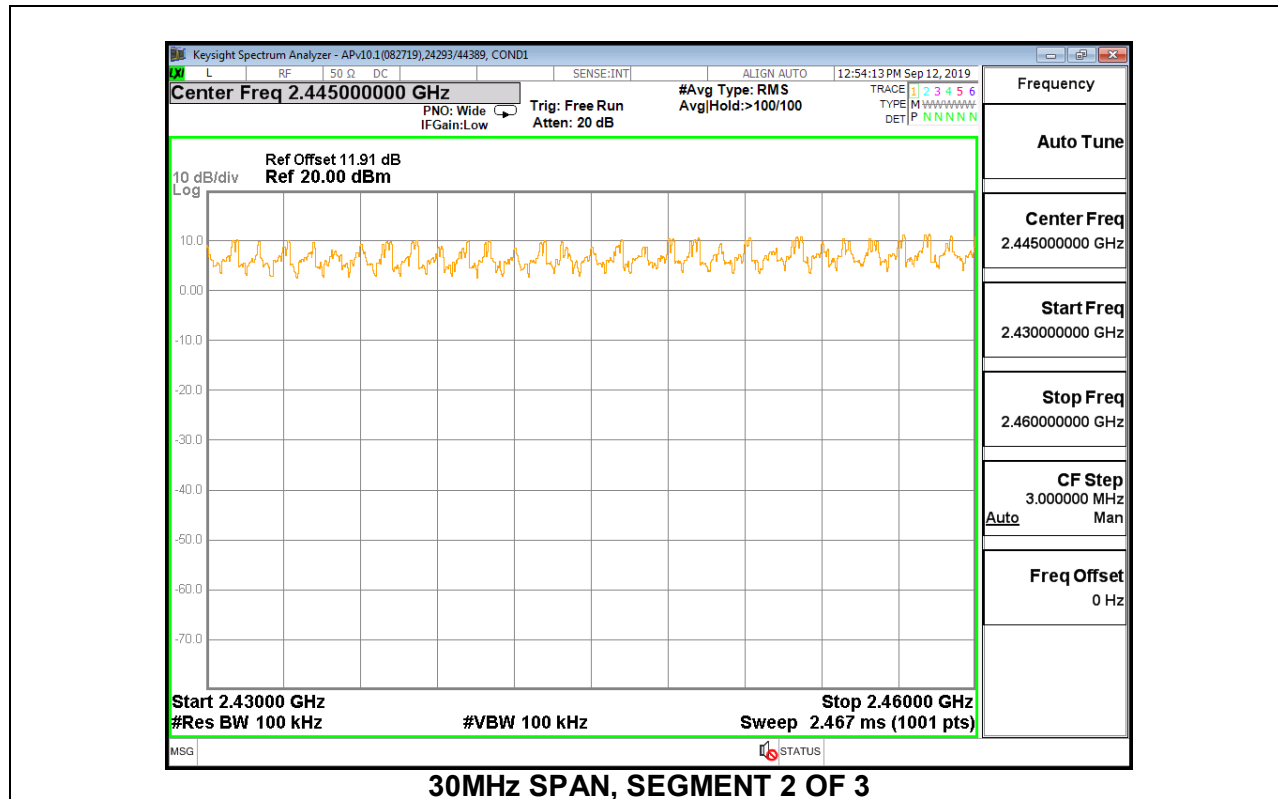
8.4.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION



100MHz SPAN



30MHz SPAN, SEGMENT 1 OF 3



8.5. AVERAGE TIME OF OCCUPANCY

LIMITS

FCC §15.247 (a) (1) (iii)
RSS-247 (5.1) (d)

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.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

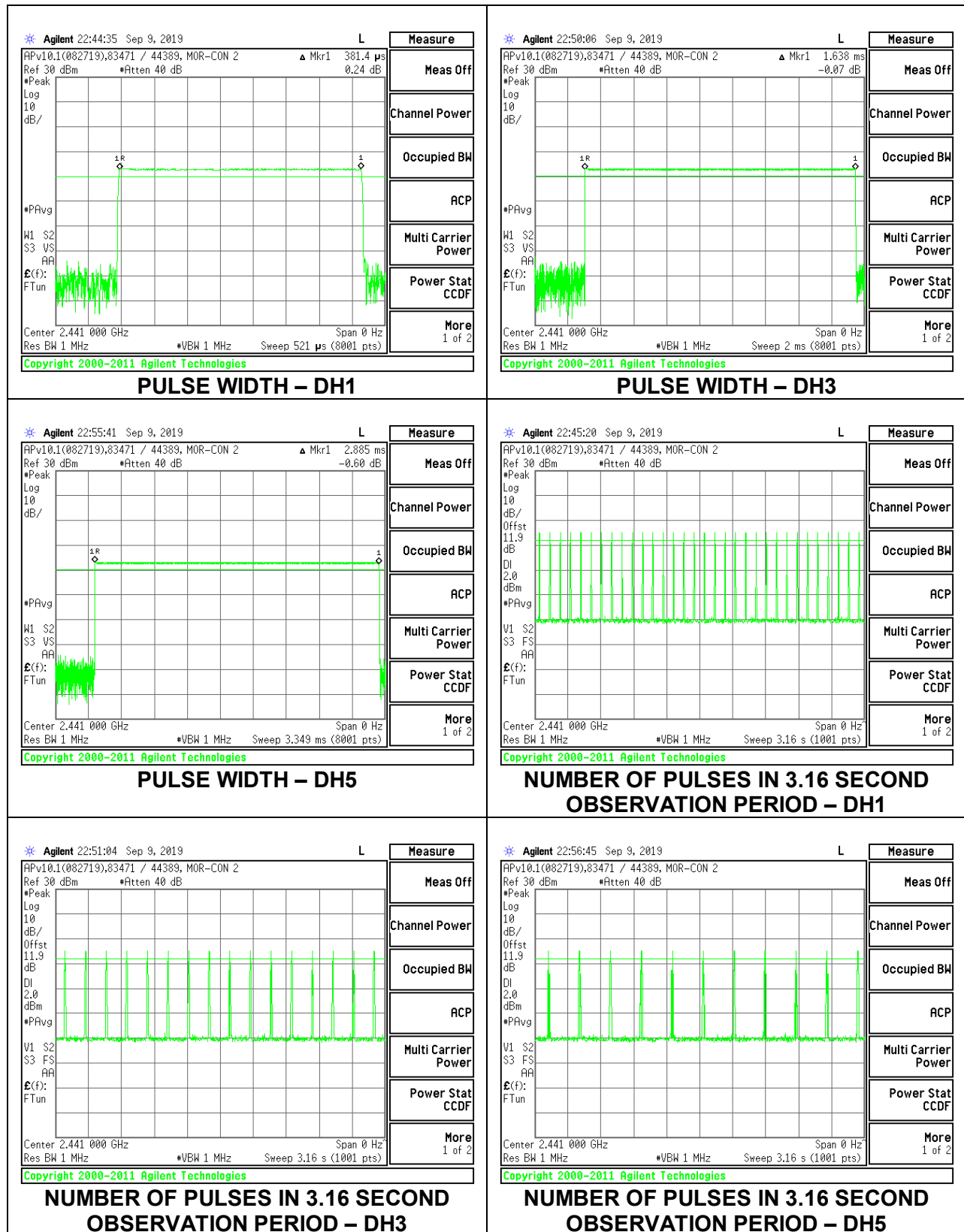
The average time of occupancy in the specified 3.16 second period (79 channels * 0.4 s) is equal to $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{pulse width}$.

For AFH mode, the average time of occupancy in the specified 8 second period (20 channels * 0.4 seconds) is equal to $10 * (\# \text{ of pulses in } 0.8 \text{ s}) * \text{pulse width}$.

RESULTS

8.5.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK Normal Mode					
DH1	0.3814	32	0.1220	0.4	-0.2780
DH3	1.638	16	0.2621	0.4	-0.1379
DH5	2.885	11	0.3174	0.4	-0.0827
DH Packet	Pulse Width (sec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK AFH Mode					
DH1	0.3814	8	0.03051	0.4	-0.3695
DH3	1.638	4	0.06552	0.4	-0.3345
DH5	2.885	2.75	0.07934	0.4	-0.3207



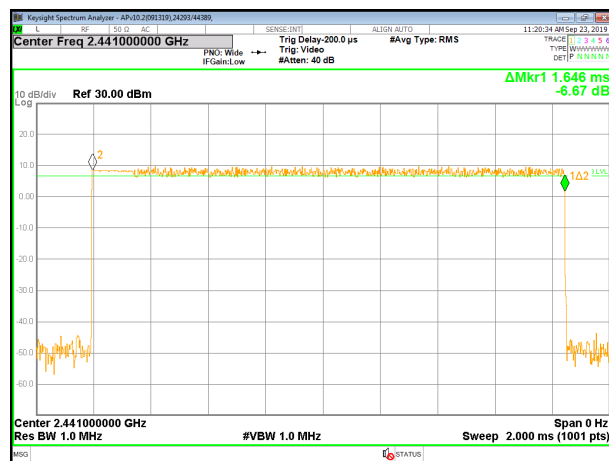
8.5.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
8PSK Normal Mode					
3DH1	0.396	32	0.12672	0.4	-0.2733
3DH3	1.646	16	0.26336	0.4	-0.1366
3DH5	2.892	10	0.2892	0.4	-0.1108

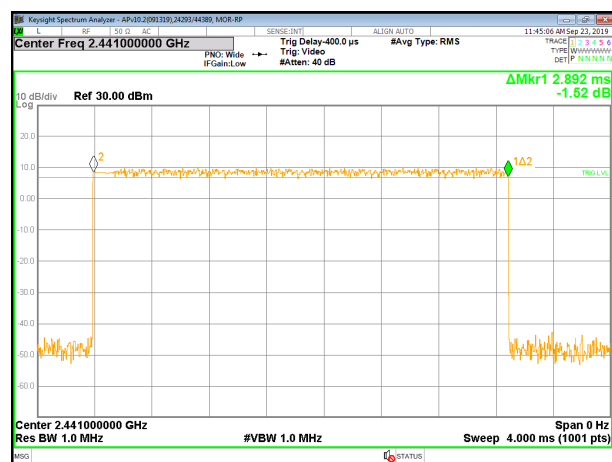
Note: for AFH(8PSK) mode, please refer to the results of AFH(GFSK) mode; the channel selection and hopping rate are the same for both EDR and Basic Rate operation, data for Basic Rate demonstrates compliance with channel occupancy when AFH is employed.



PULSE WIDTH – 3DH1



PULSE WIDTH – 3DH3



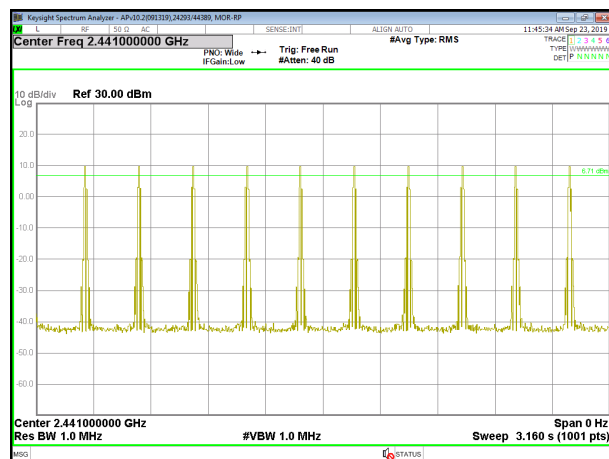
PULSE WIDTH – 3DH5



**NUMBER OF PULSES IN 3.16 SECOND
OBSERVATION PERIOD – 3DH1**



**NUMBER OF PULSES IN 3.16 SECOND
OBSERVATION PERIOD – 3DH3**



**NUMBER OF PULSES IN 3.16 SECOND
OBSERVATION PERIOD – 3DH5**

8.6. OUTPUT POWER

LIMITS

§15.247 (b) (1)

RSS-247 (5.4) (b)

The maximum antenna gain is less than 6 dBi, therefore the limit is 30 dBm. 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.

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

TEST PROCEDURE

Measurements perform using a wideband gated RF power meter.

The cable assembly insertion loss of 10.26 dB (including 10 dB pad and 0.26 dB cable) was entered as an offset in the power meter to allow for a gated peak reading of power.

RESULTS

8.6.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Tested By:	24293/44389
Date:	2019-09-12

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	9.79	30	-20.21
Middle	2441	10.19	30	-19.81
High	2480	9.29	30	-20.71

8.6.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Tested By:	24293/44389
Date:	2019-09-12

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	10.09	21	-10.91
Middle	2441	10.05	21	-10.95
High	2480	9.47	21	-11.53

8.6.3. BLUETOOTH ENHANCED DATA RATE DQPSK MODULATION

Tested By:	24293/44389
Date:	2019-09-12

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	9.45	21	-11.55
Middle	2441	9.65	21	-11.35
High	2480	9.02	21	-11.98

8.7. AVERAGE POWER

LIMITS

None; for reporting purposes only

TEST PROCEDURE

Measurements perform using a wideband gated RF power meter.

The cable assembly insertion loss of 10.26 dB (including 10 dB pad and 0.26 dB cable) was entered as an offset in the power meter to allow for a gated average reading of power.

RESULTS

8.7.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Tested By:	24293/44389
Date	2019-09-12

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	9.63
Middle	2441	9.85
High	2480	9.11

8.7.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Tested By:	24293/44389
Date	2019-09-12

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	7.18
Middle	2441	7.02
High	2480	6.55

8.7.3. BLUETOOTH ENHANCED DATA RATE DQPSK MODULATION

Tested By:	24293/44389
Date	2019-09-12

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	7.35
Middle	2441	7.23
High	2480	6.81

8.8. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

RSS-247 5.5

Limit = -20 dBc

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

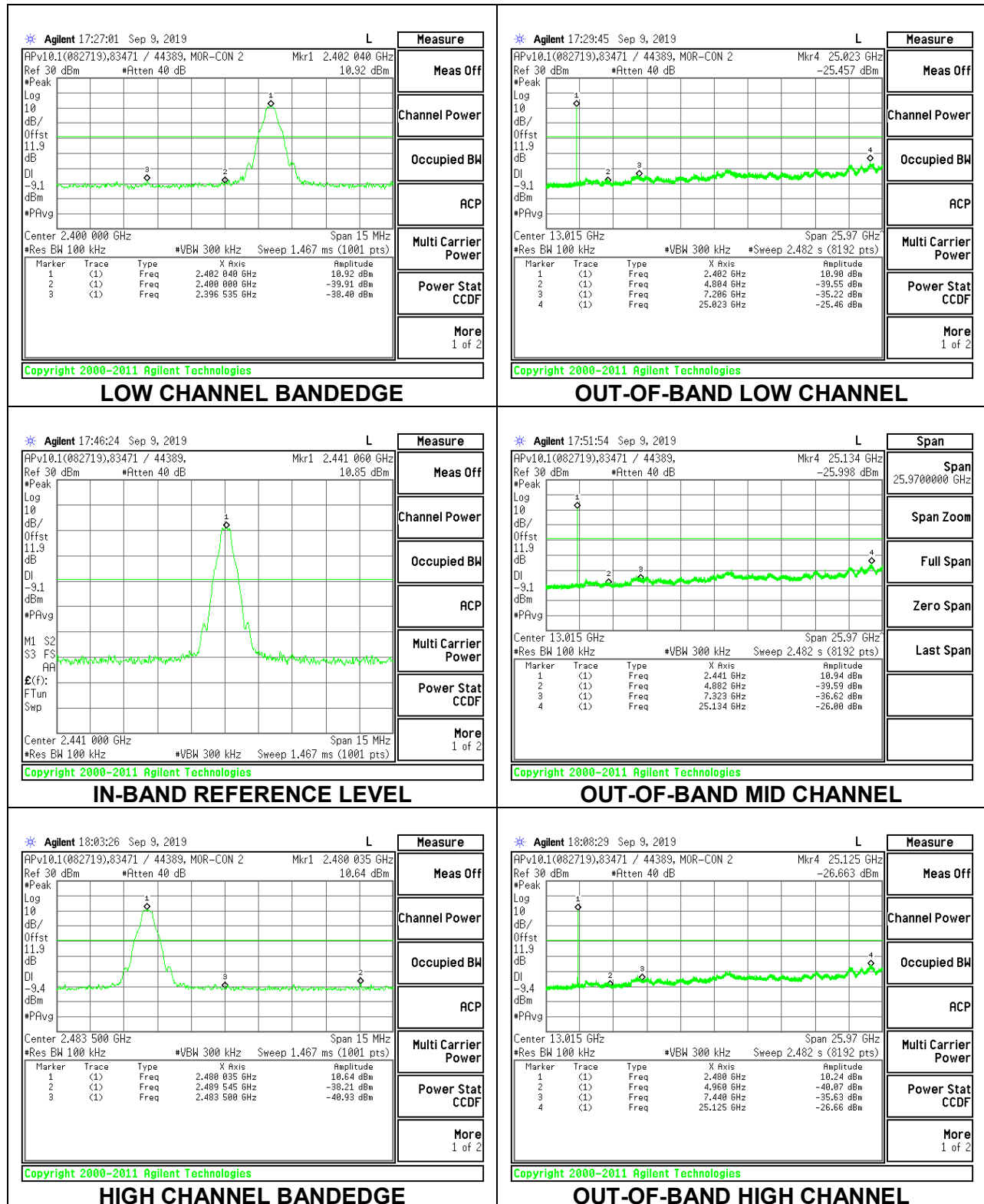
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

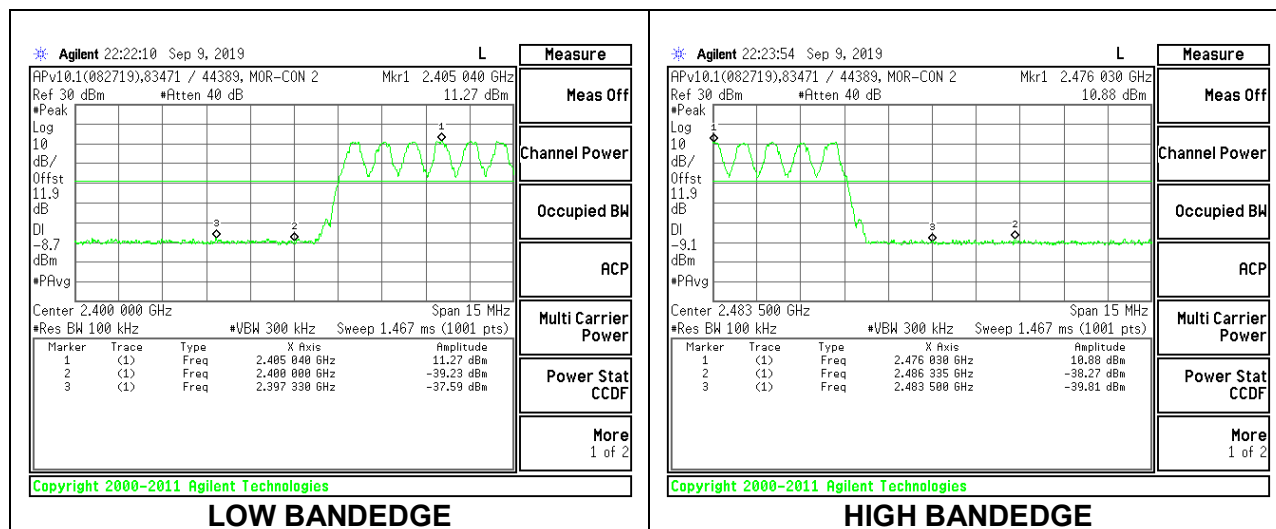
RESULTS

8.8.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Antenna 1 SPURIOUS EMISSIONS, NON-HOPPING

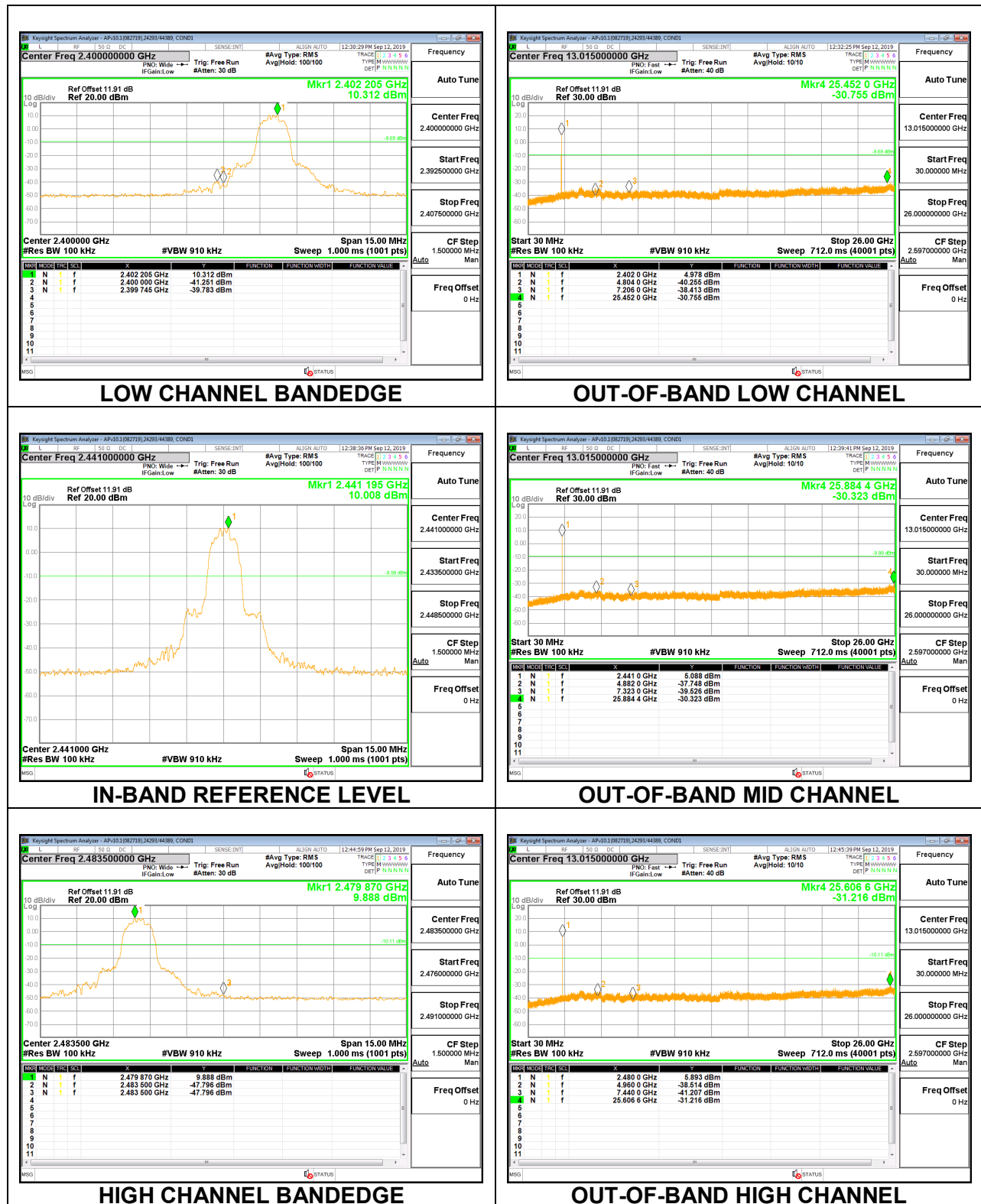


Antenna 1 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

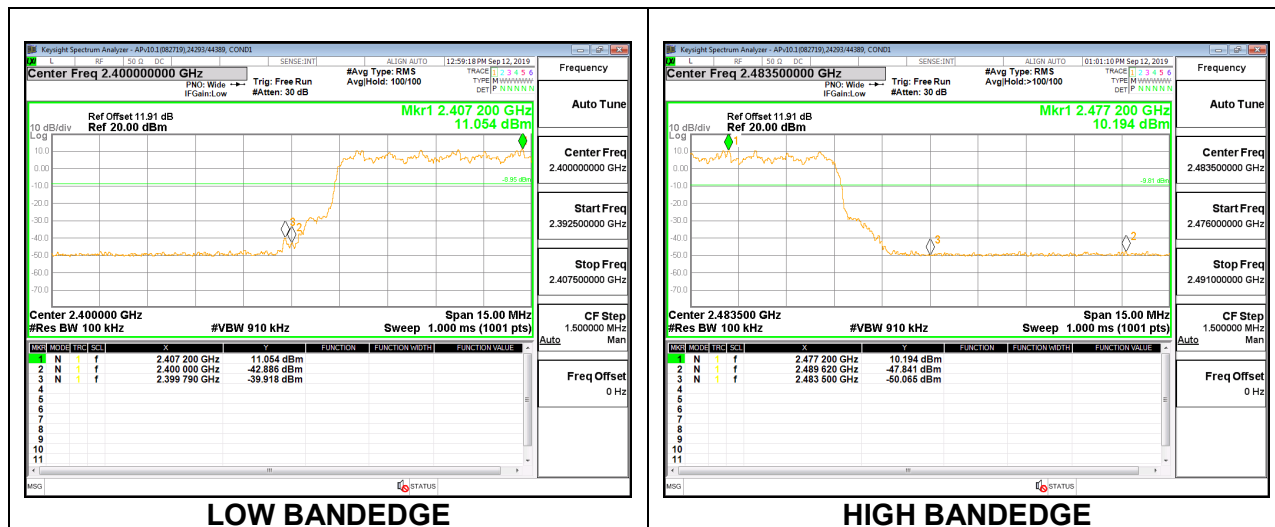


8.8.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Antenna 1 SPURIOUS EMISSIONS, NON-HOPPING



Antenna 1 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



9. RADIATED TEST RESULTS

LIMITS

FCC §15.205 and §15.209
RSS-GEN, Section 8.9 and 8.10.

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
0.009-0.490	2400/F(kHz) @ 300 m	-
0.490-1.705	24000/F(kHz) @ 30 m	-
1.705 - 30	30 @ 30m	-
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 1GHz; 1.5 m above the ground plane for measurement above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 200 Hz for measurements from 9kHz to 150kHz, 9kHz for measurements from 150kHz to 30 MHz and 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements from 30-1000 MHz. Peak detection is used unless otherwise noted as quasi-peak.

For pre-scans from 1-18 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 KHz for peak measurements.

For final measurements from 1-18 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements. For average measurements, a duty cycle correction was subtracted from the peak measurement. Refer to the KDB 558074 D01 15.247 Meas Guidance v05r02 section below for further explanation.

For scans above 18 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz.

The spectrum from 1 GHz to 18 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band. Below 1GHz and above 18GHz emissions, the channel with the highest output power was tested.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

3D antenna use - For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel).

KDB 414788 Open Field Site(OFS) and Chamber Correlation Justification

Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

KDB 558074 D01 15.247 Meas Guidance v05r02

Use of a duty cycle correction factor (DCCF) is permitted for calculating average radiated field strength emission levels for an FHSS device in 15.247. This DCCF can be applied when the field strength limit (e.g., within a Government Restricted band) and the conditions specified in Section 15.35(c) can be satisfied. The average radiated field strength is calculated by subtracting the DCCF from the maximum radiated field strength level as determined through measurement. The maximum radiated field strength level represents the worst-case (maximum amplitude) RMS measurement of the emission(s) during continuous transmission (i.e., not including any time intervals during which the transmitter is off or is transmitting at a reduced power level). It is also acceptable to apply the DCCF to a measurement performed with a peak detector instead of the specified RMS power averaging detector. Note that Section 15.35(c) specifies that the DCCF shall represent the worst-case (greatest duty cycle) over any 100 msec transmission period.

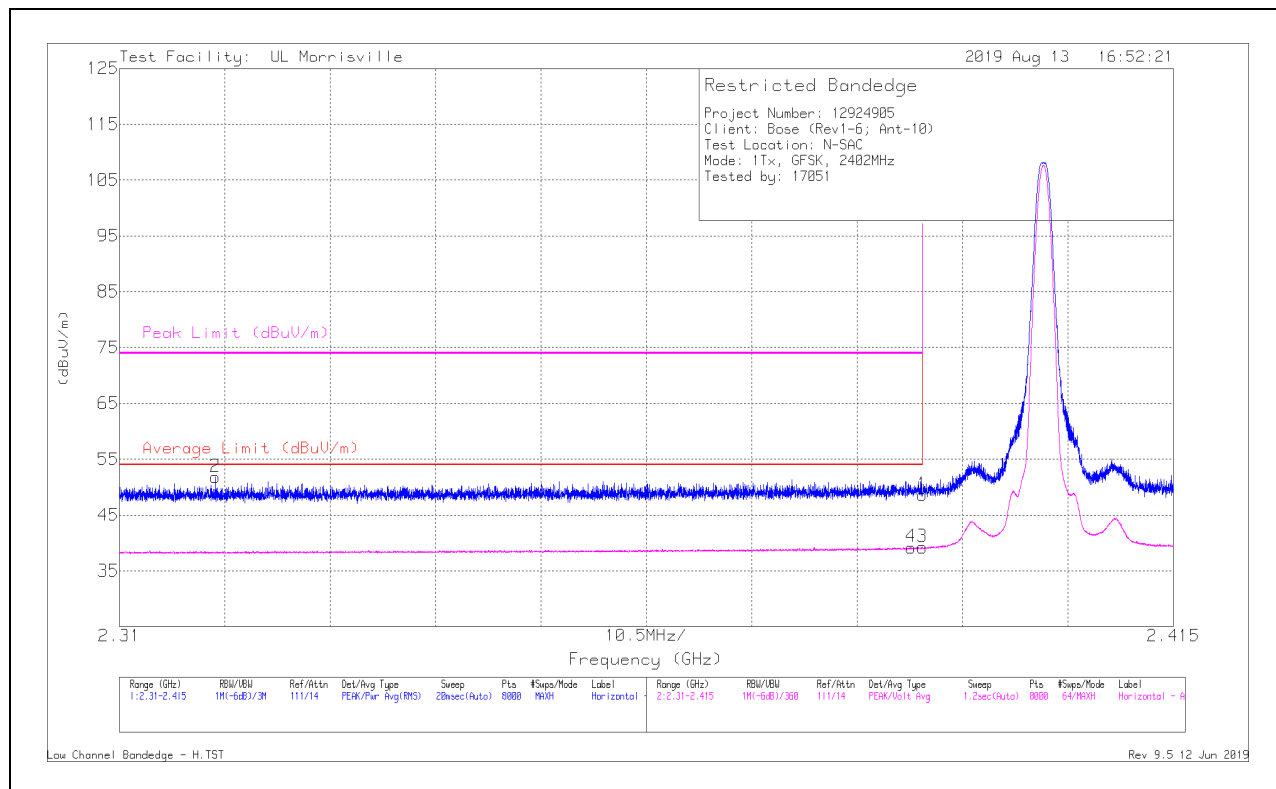
Note – For this test program, Peak detection was used. The DCCF was then subtracted from the peak value. The DCCF was calculated based on the worst case on-time when the device transmits DH5 packets and operates on 20 channels (5/1600 s per hop = 3.125 ms per channel). In this mode, the device will have a maximum of 2 hops on a channel in 100ms or $2 \times 3.125 \text{ ms} = 6.25 \text{ ms}$ on any channel. Therefore, $20 \log (6.25 / 100) = -24 \text{ dB}$.

9.1. TRANSMITTER ABOVE 1 GHz

9.1.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



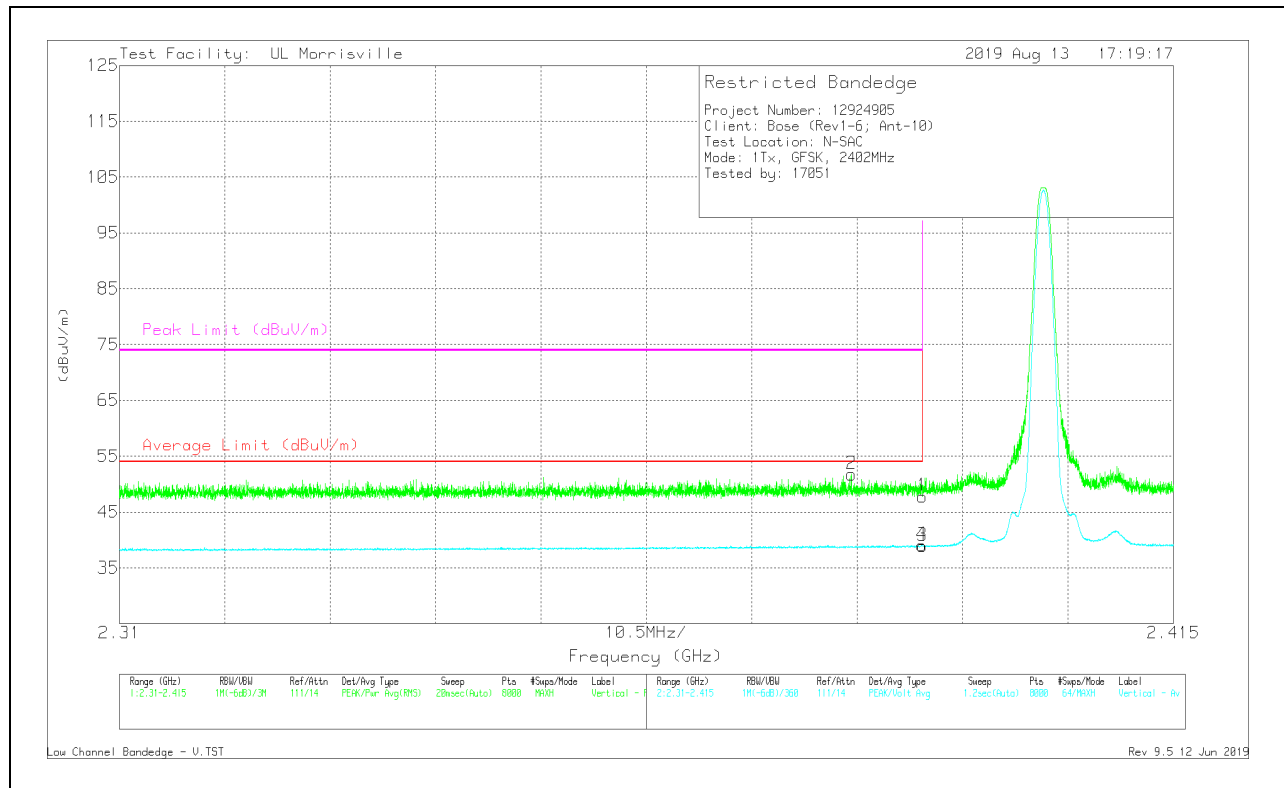
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 AF (dBuV/m)	Amp/Cbl/Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.39	41.12	Pk	32	-24.5	0	48.62	-	-	74	-25.38	177	100	H
	* ** 2.39	41.12	Pk	32	-24.5	-24	24.62	54	-29.38	-	-	177	100	H
2	* ** 2.31954	44.78	Pk	31.7	-24.7	0	51.78	-	-	74	-22.22	177	100	H
	* ** 2.31954	44.78	Pk	31.7	-24.7	-24	27.78	54	-26.22	-	-	177	100	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 AF (dBuV/m)	Amp/Cbl/Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	*** 2.39	40.32	Pk	32	-24.5	0	47.82	-	-	74	-26.18	105	103	V
	*** 2.39	40.32	Pk	32	-24.5	-24	23.82	54	-30.18	-	-	105	103	V
2	*** 2.38291	44.27	Pk	32	-24.5	0	51.77	-	-	74	-22.23	105	103	V
	*** 2.38291	44.27	Pk	32	-24.5	-24	27.77	54	-26.23	-	-	105	103	V

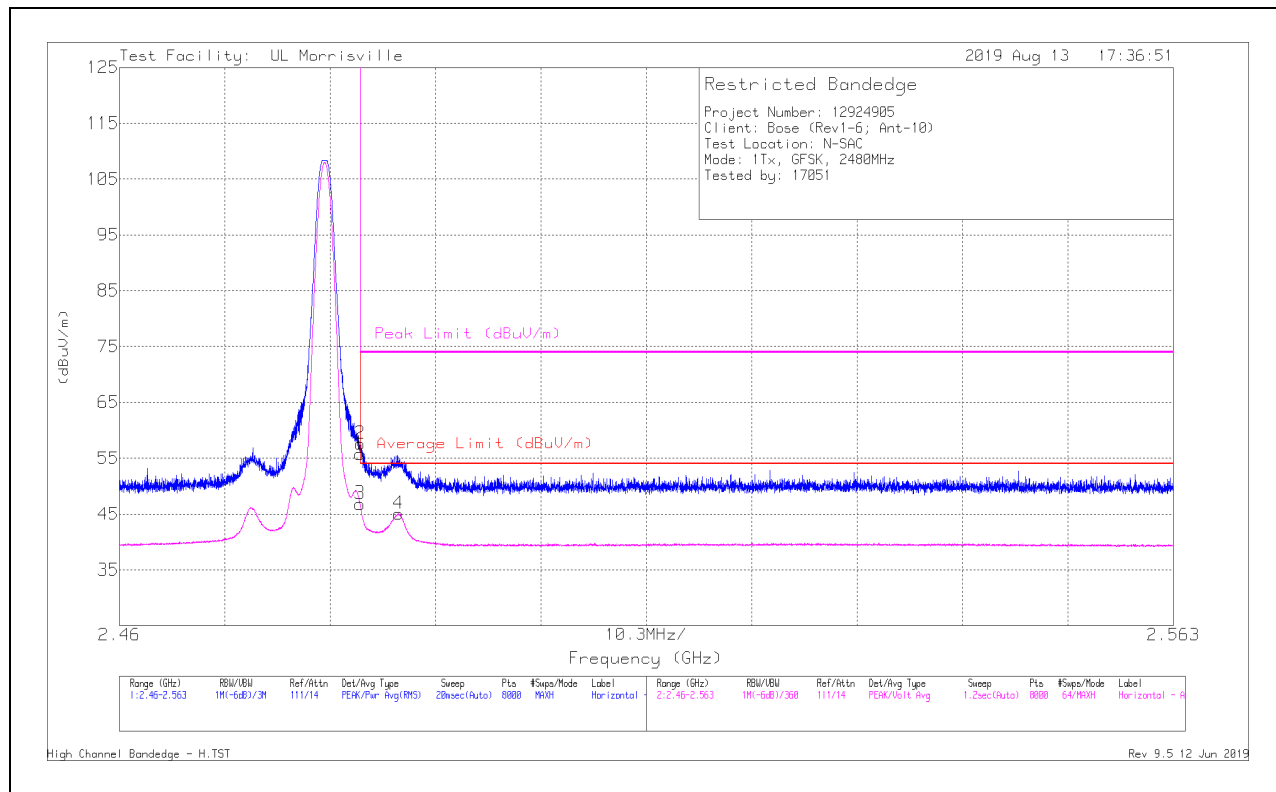
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

BANEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



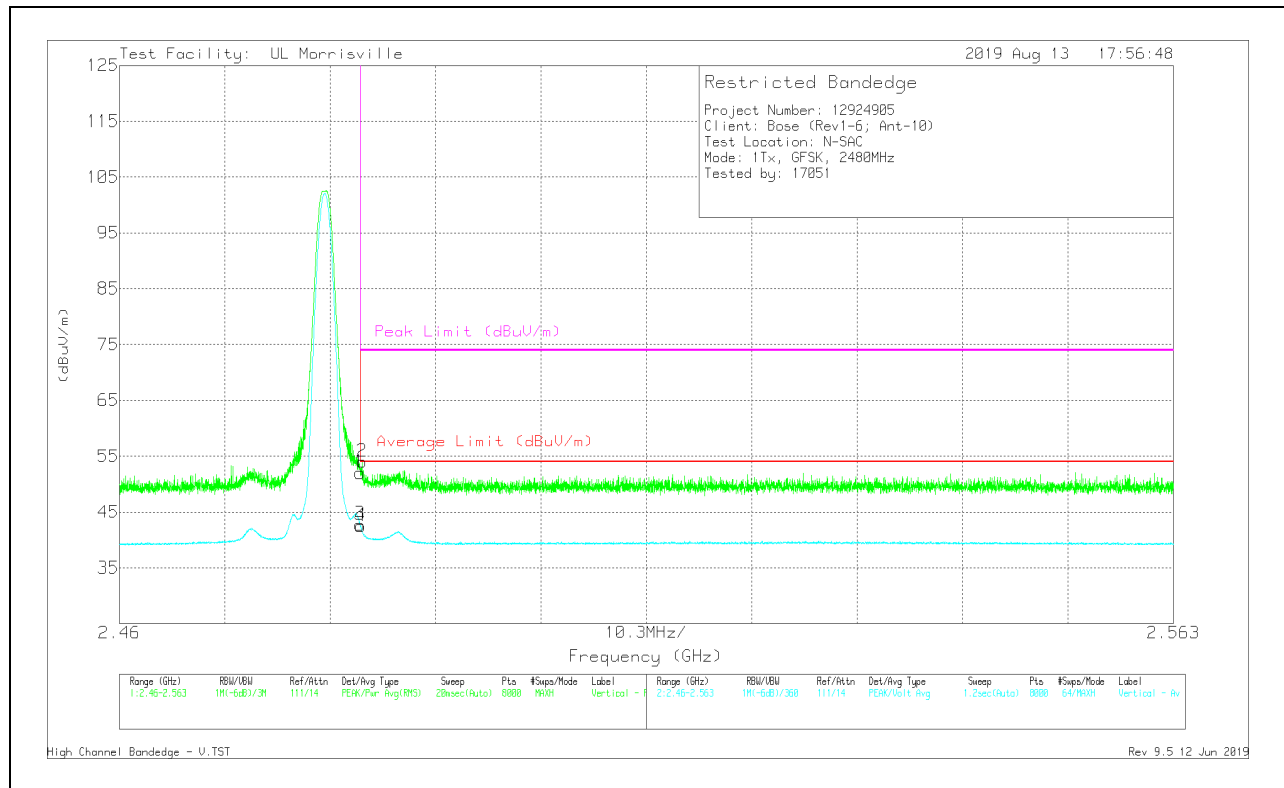
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 AF (dBuV/m)	Amp/Cbl/Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.4835	47.68	Pk	32.4	-24.3	0	55.78	-	-	74	-18.22	179	112	H
	* ** 2.4835	47.68	Pk	32.4	-24.3	-24	31.78	54	-22.22	-	-	179	112	H
2	* ** 2.48355	49.47	Pk	32.4	-24.3	0	57.57	-	-	74	-16.43	179	112	H
	* ** 2.48355	49.47	Pk	32.4	-24.3	-24	33.57	54	-20.43	-	-	179	112	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 AF (dBuV/m)	Amp/Cbl/Filtr/ Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.4835	43.92	Pk	32.4	-24.3	0	52.02	-	-	74	-21.98	54	323	V
	* ** 2.4835	43.92	Pk	32.4	-24.3	-24	28.02	54	-25.98	-	-	54	323	V
2	* ** 2.48371	45.91	Pk	32.4	-24.3	0	54.01	-	-	74	-19.99	54	323	V
	* ** 2.48371	45.91	Pk	32.4	-24.3	-24	30.01	54	-23.99	-	-	54	323	V

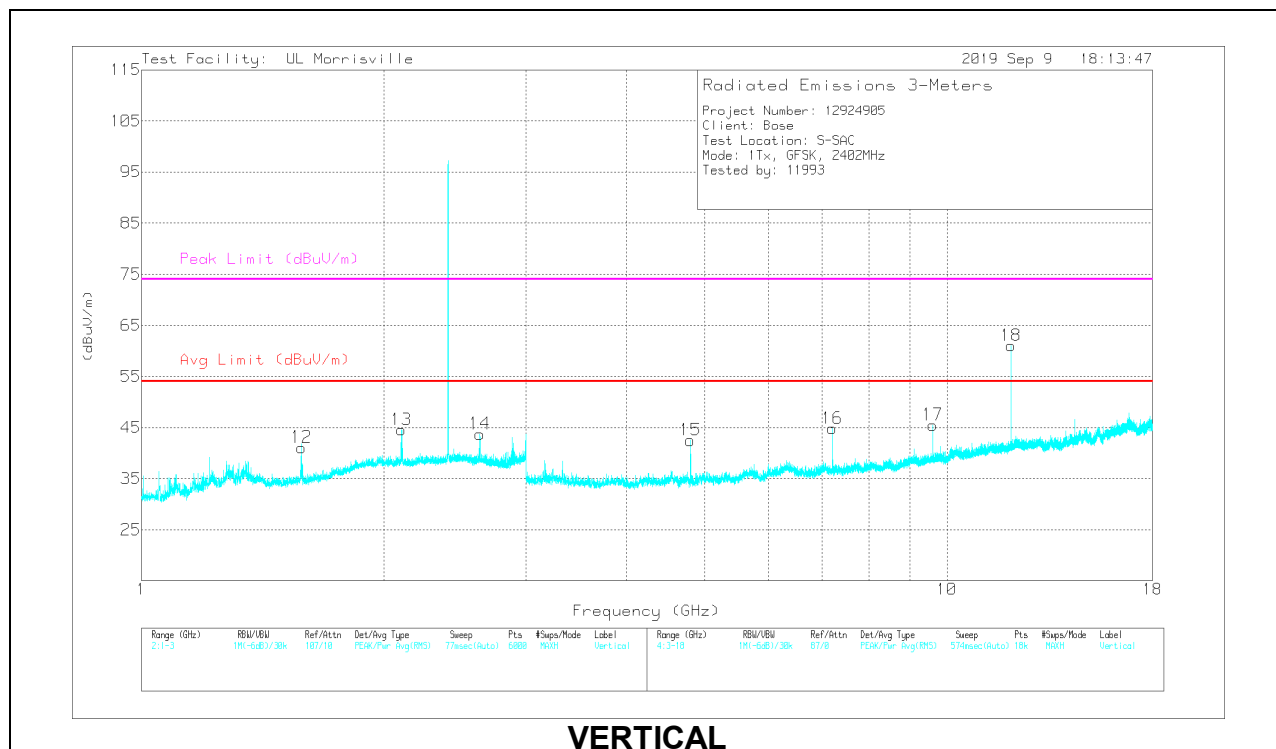
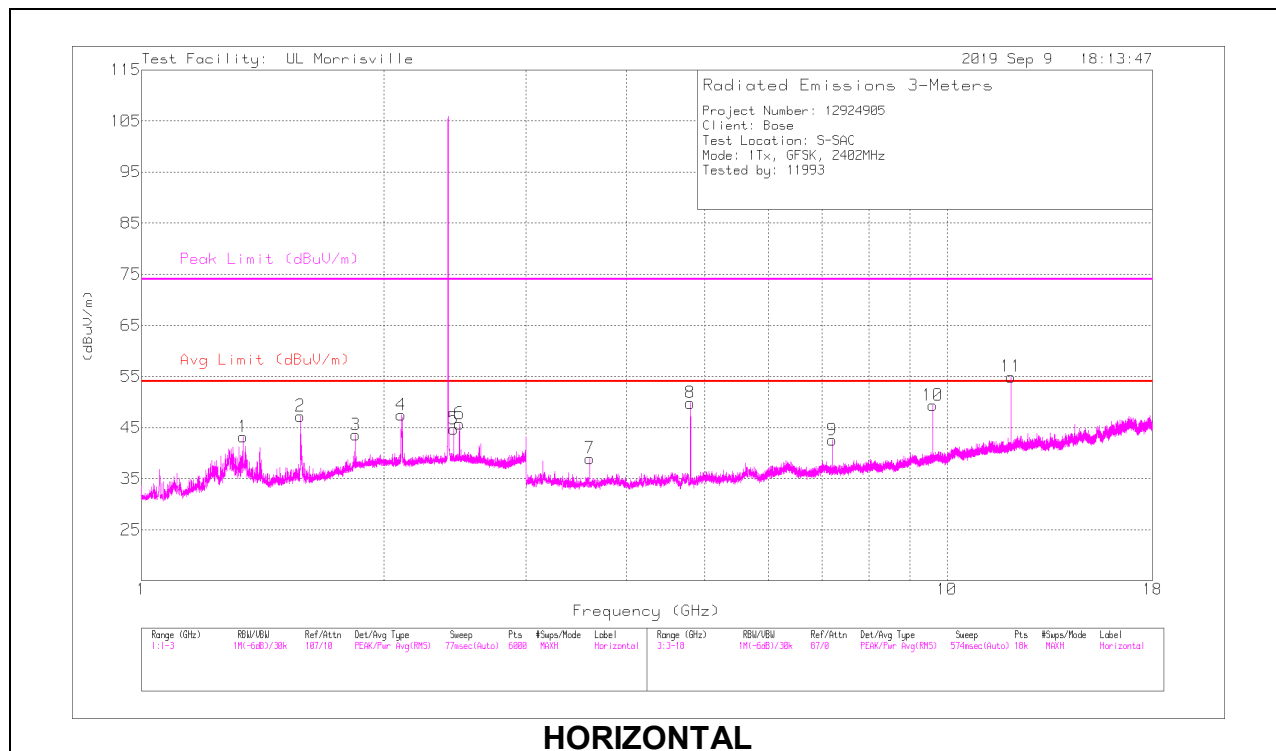
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Ftr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	*** 1.33797	42.98	PK-U	29.1	-23	0	49.08	-	-	74	-24.92	235	237	H
	*** 1.33797	42.98	PK-U	29.1	-23	-24	25.08	54	-28.92	-	-	235	237	H
2	*** 1.57707	45.19	PK-U	27.9	-22.2	0	50.89	-	-	74	-23.11	116	145	H
	*** 1.57707	45.19	PK-U	27.9	-22.2	-24	26.89	54	-27.11	-	-	116	145	H
3	** 1.84195	42.6	PK-U	30.8	-22.3	0	51.1	-	-	74	-22.9	188	271	H
	** 1.84195	42.6	PK-U	30.8	-22.3	-24	27.1	54	-26.9	-	-	188	271	H
12	*** 1.58073	49.13	PK-U	27.9	-22.3	0	54.73	-	-	74	-19.27	99	321	V
	*** 1.58073	49.13	PK-U	27.9	-22.3	-24	30.73	54	-23.27	-	-	99	321	V
14	** 2.63137	46.29	PK-U	32.4	-25.3	0	53.39	-	-	74	-20.61	180	239	V
	** 2.63137	46.29	PK-U	32.4	-25.3	-24	29.39	54	-24.61	-	-	180	239	V
7	*** 3.60274	43.37	PK-U	32.9	-31.6	0	44.67	-	-	74	-29.33	53	240	H
	*** 3.60274	43.37	PK-U	32.9	-31.6	-24	20.67	54	-33.33	-	-	53	240	H
8	*** 4.80446	49.27	PK-U	34.2	-31	0	52.47	-	-	74	-21.53	18	114	H
	*** 4.80446	49.27	PK-U	34.2	-31	-24	28.47	54	-25.53	-	-	18	114	H
11	*** 12.01015	40.07	PK-U	38.7	-23.7	0	55.07	-	-	74	-18.93	89	122	H
	*** 12.01015	40.07	PK-U	38.7	-23.7	-24	31.07	54	-22.93	-	-	89	122	H
15	*** 4.80435	44.49	PK-U	34.2	-31	0	47.69	-	-	74	-26.31	74	104	V
	*** 4.80435	44.49	PK-U	34.2	-31	-24	23.69	54	-30.31	-	-	74	104	V
18	*** 12.01097	48.29	PK-U	38.7	-23.7	0	63.29	-	-	74	-10.71	47	101	V
	*** 12.01097	48.29	PK-U	38.7	-23.7	-24	39.29	54	-14.71	-	-	47	101	V
4	2.10052	39.15	Pk	31.2	-22.9	0	47.45	-	-	-	-	0-360	101	H
13	2.10152	36.3	Pk	31.2	-22.9	0	44.6	-	-	-	-	0-360	101	V
5	2.44224	36.85	Pk	32.1	-24.2	0	44.75	-	-	-	-	0-360	101	H
6	2.48191	37.96	Pk	32.3	-24.5	0	45.76	-	-	-	-	0-360	101	H
9	7.20524	34.84	Pk	35.7	-28	0	42.54	-	-	-	-	0-360	101	H
16	7.20607	37.09	Pk	35.7	-28	0	44.79	-	-	-	-	0-360	199	V
17	9.60787	34.41	Pk	37.1	-26	0	45.51	-	-	-	-	0-360	199	V
10	9.6087	38.25	Pk	37.1	-26	0	49.35	-	-	-	-	0-360	101	H

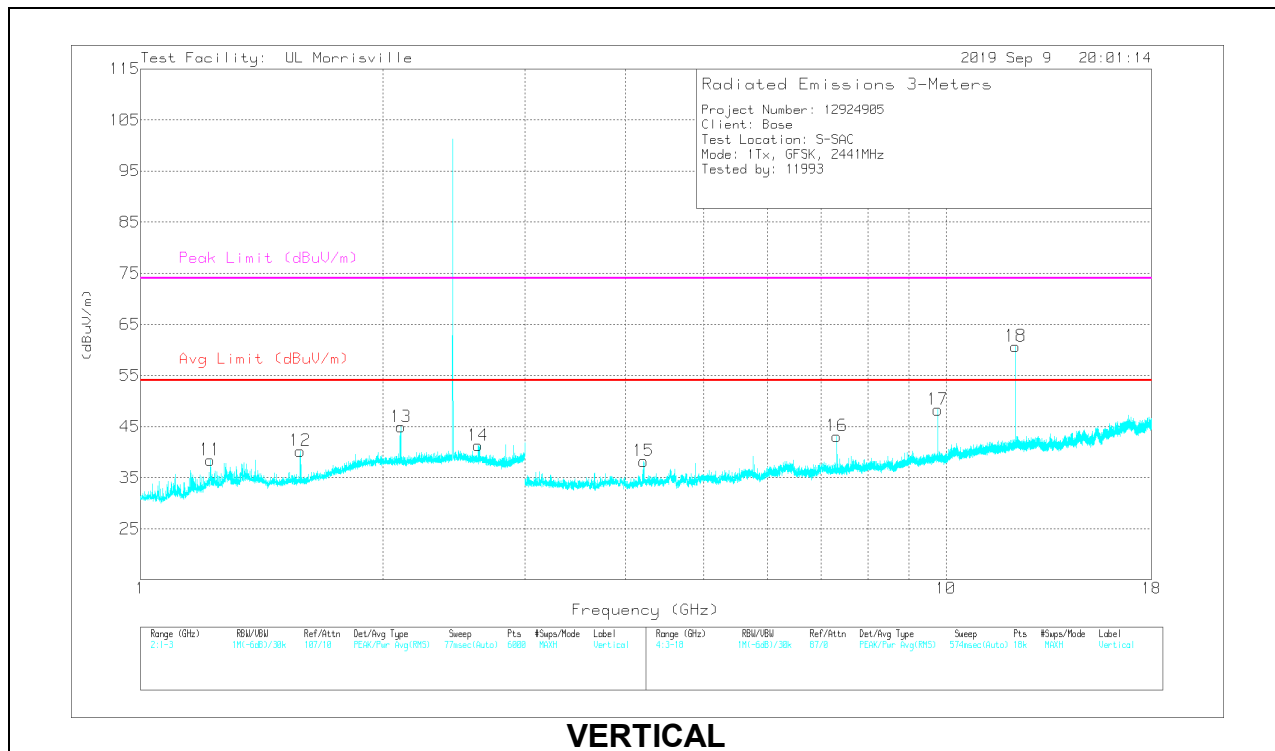
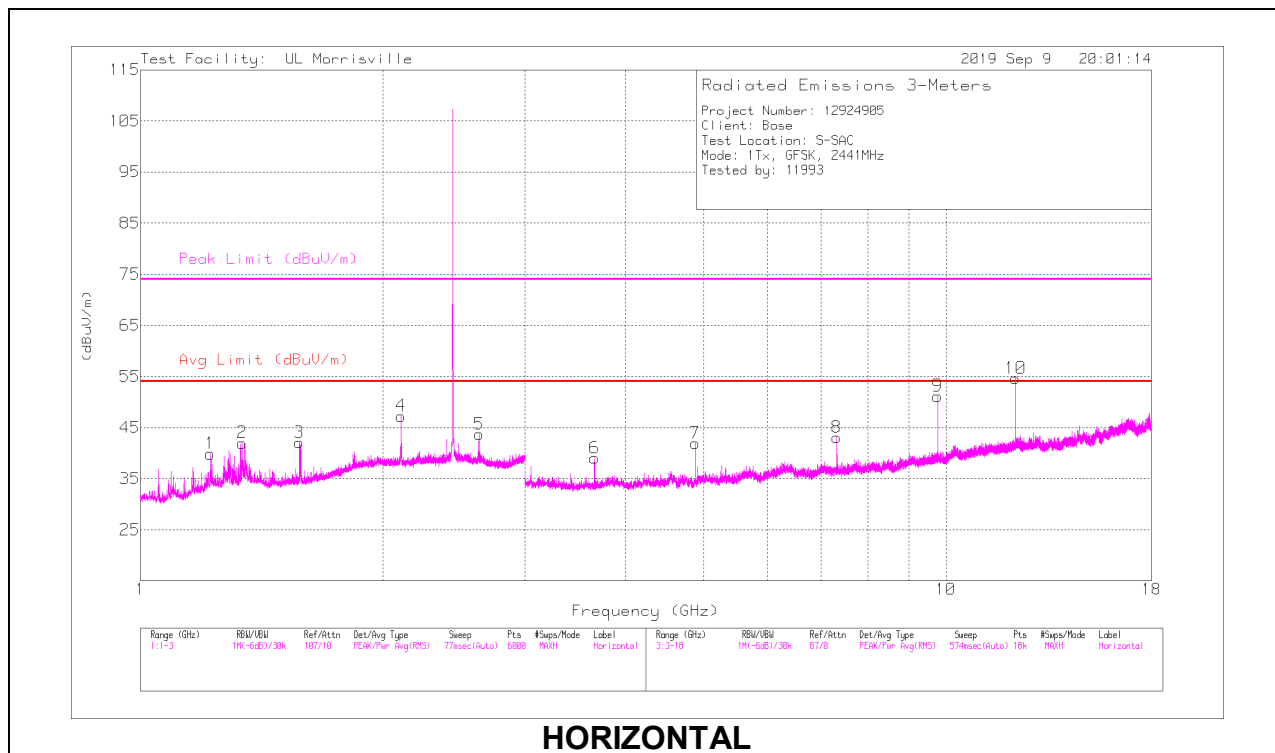
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

PK-U - U-NII: Maximum Peak

Pk - Peak detector

MID CHANNEL RESULTS



RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Fitr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	*** 1.22067	39.74	PK-U	28.7	-23.6	0	44.84	-	-	74	-29.16	188	191	H
1	*** 1.22067	39.74	PK-U	28.7	-23.6	-24	20.84	54	-33.16	-	-	188	191	H
2	*** 1.33642	45.07	PK-U	29	-23	0	51.07	-	-	74	-22.93	231	233	H
2	*** 1.33642	45.07	PK-U	29	-23	-24	27.07	54	-26.93	-	-	231	233	H
3	*** 1.57475	48.04	PK-U	27.9	-22.2	0	53.74	-	-	74	-20.26	72	109	H
3	*** 1.57475	48.04	PK-U	27.9	-22.2	-24	29.74	54	-24.26	-	-	72	109	H
5	** 2.63617	44.44	PK-U	32.5	-25.3	0	51.64	-	-	74	-22.36	271	265	H
5	** 2.63617	44.44	PK-U	32.5	-25.3	-24	27.64	54	-26.36	-	-	271	265	H
11	*** 1.22053	39.99	PK-U	28.7	-23.6	0	45.09	-	-	74	-28.91	113	269	V
11	*** 1.22053	39.99	PK-U	28.7	-23.6	-24	21.09	54	-32.91	-	-	113	269	V
12	*** 1.58005	46.39	PK-U	27.9	-22.2	0	52.09	-	-	74	-21.91	92	364	V
12	*** 1.58005	46.39	PK-U	27.9	-22.2	-24	28.09	54	-25.91	-	-	92	364	V
14	** 2.62432	40.34	PK-U	32.4	-25.3	0	47.44	-	-	74	-26.56	177	252	V
14	** 2.62432	40.34	PK-U	32.4	-25.3	-24	23.44	54	-30.56	-	-	177	252	V
6	*** 3.66187	44.18	PK-U	32.9	-32.1	0	44.98	-	-	74	-29.02	25	309	H
6	*** 3.66187	44.18	PK-U	32.9	-32.1	-24	20.98	54	-33.02	-	-	25	309	H
7	*** 4.88219	43.53	PK-U	34	-30.6	0	46.93	-	-	74	-27.07	357	105	H
7	*** 4.88219	43.53	PK-U	34	-30.6	-24	22.93	54	-31.07	-	-	357	105	H
8	*** 7.32359	38.96	PK-U	35.7	-27.5	0	47.16	-	-	74	-26.84	18	110	H
8	*** 7.32359	38.96	PK-U	35.7	-27.5	-24	23.16	54	-30.84	-	-	18	110	H
10	*** 12.20602	42.18	PK-U	38.9	-23.8	0	57.28	-	-	74	-16.72	78	226	H
10	*** 12.20602	42.18	PK-U	38.9	-23.8	-24	33.28	54	-20.72	-	-	78	226	H
15	*** 4.21066	43.54	PK-U	33.4	-31.2	0	45.74	-	-	74	-28.26	256	219	V
15	*** 4.21066	43.54	PK-U	33.4	-31.2	-24	21.74	54	-32.26	-	-	256	219	V
16	*** 7.32354	40.68	PK-U	35.7	-27.5	0	48.88	-	-	74	-25.12	202	103	V
16	*** 7.32354	40.68	PK-U	35.7	-27.5	-24	24.88	54	-29.12	-	-	202	103	V
18	*** 12.20598	47.95	PK-U	38.9	-23.8	0	63.05	-	-	74	-10.95	39	101	V
18	*** 12.20598	47.95	PK-U	38.9	-23.8	-24	39.05	54	-14.95	-	-	39	101	V
4	2.10418	39.07	Pk	31.2	-23	0	47.27	-	-	-	-	0-360	101	H
13	2.10519	36.77	Pk	31.2	-23	0	44.97	-	-	-	-	0-360	199	V
9	9.76288	39.67	Pk	37.1	-25.6	0	51.17	-	-	-	-	0-360	101	H
17	9.76455	36.8	Pk	37.1	-25.6	0	48.3	-	-	-	-	0-360	199	V

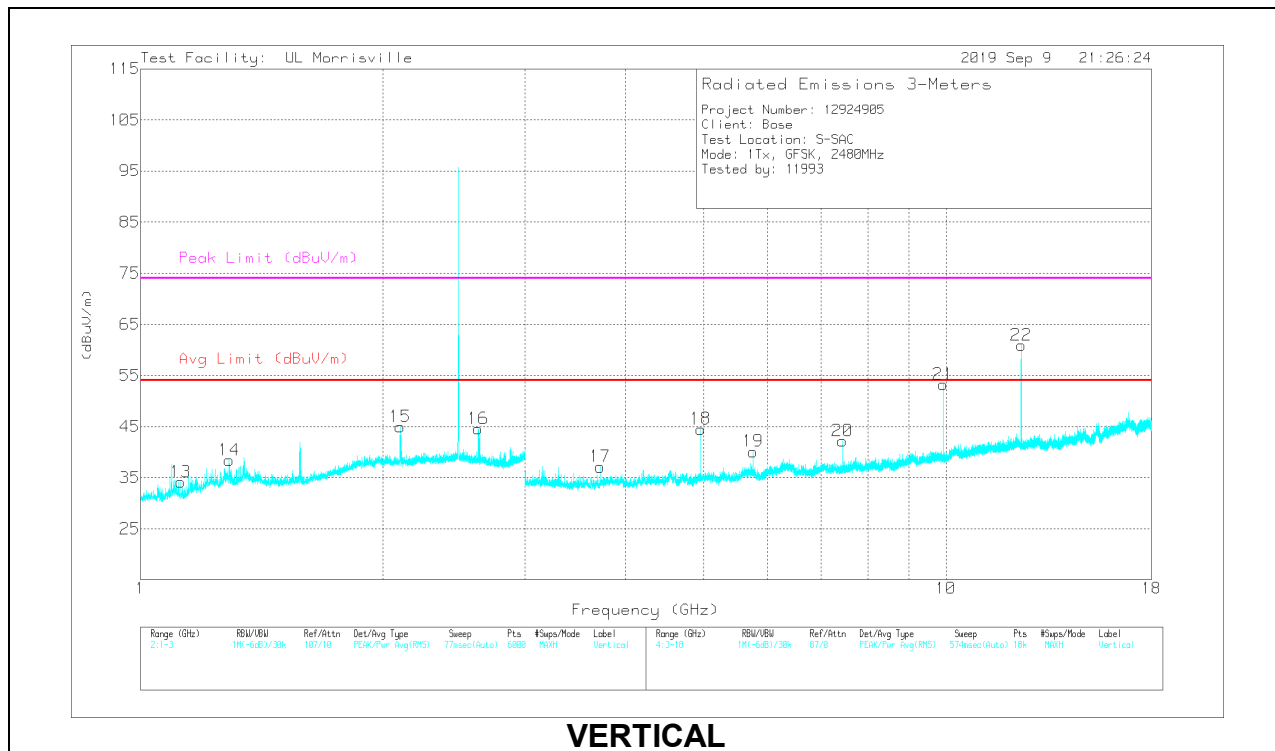
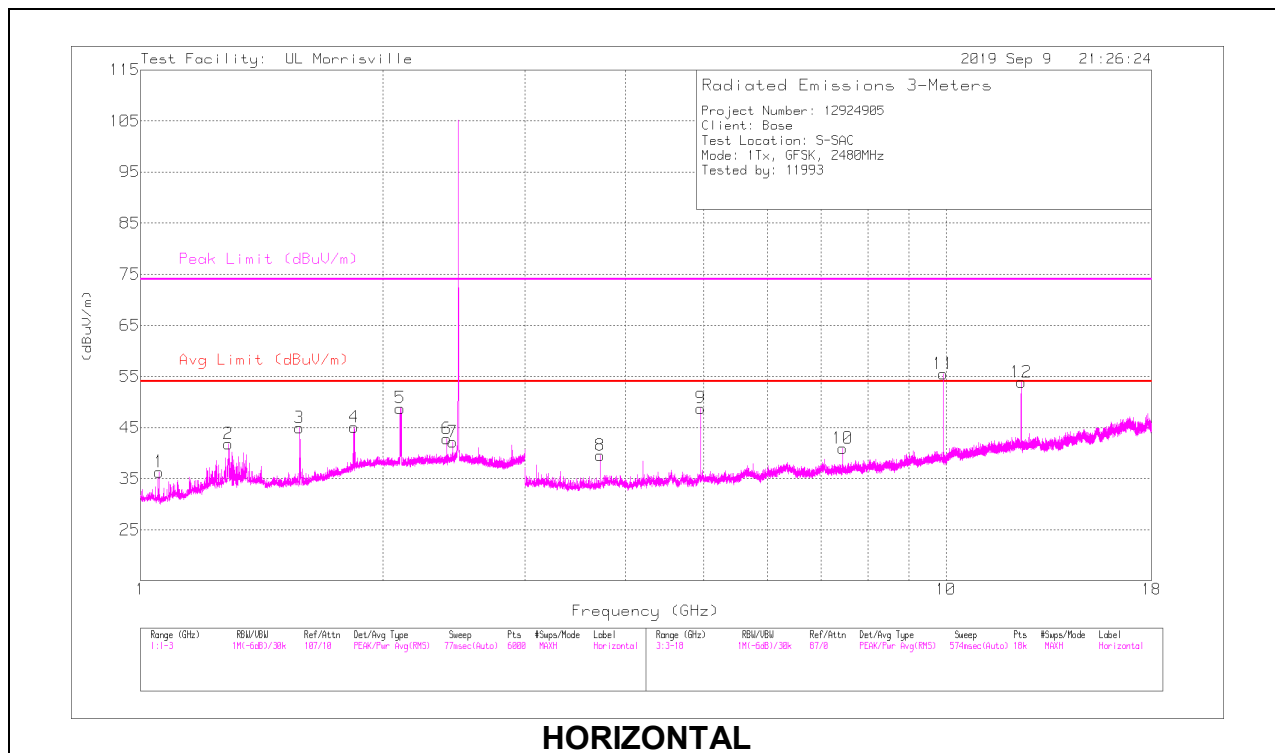
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

PK-U - U-NII: Maximum Peak

Pk - Peak detector

HIGH CHANNEL RESULTS



RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	DCCF (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	*** 1.05376	41.27	PK-U	27	-24.5	0	43.77	-	-	74	-30.23	230	215	H
1	*** 1.05376	41.27	PK-U	27	-24.5	-24	19.77	54	-34.23	-	-	230	215	H
3	*** 1.57656	46.88	PK-U	27.9	-22.2	0	52.58	-	-	74	-21.42	66	113	H
3	*** 1.57656	46.88	PK-U	27.9	-22.2	-24	28.58	54	-25.42	-	-	66	113	H
4	** 1.84316	44.53	PK-U	30.8	-22.3	0	53.03	-	-	74	-20.97	188	241	H
4	** 1.84316	44.53	PK-U	30.8	-22.3	-24	29.03	54	-24.97	-	-	188	241	H
2	* 1.28513	41.89	PK-U	29.1	-23.2	0	47.79	-	-	74	-26.21	176	310	H
2	* 1.28513	41.89	PK-U	29.1	-23.2	-24	23.79	54	-30.21	-	-	176	310	H
14	* 1.28567	40.97	PK-U	29.1	-23.2	0	46.87	-	-	74	-27.13	119	253	V
14	* 1.28567	40.97	PK-U	29.1	-23.2	-24	22.87	54	-31.13	-	-	119	253	V
13	*** 1.12274	38.86	PK-U	27.6	-24.2	0	42.26	-	-	74	-31.74	129	200	V
13	*** 1.12274	38.86	PK-U	27.6	-24.2	-24	18.26	54	-35.74	-	-	129	200	V
16	** 2.62483	38.85	PK-U	32.4	-25.3	0	45.95	-	-	74	-28.05	172	180	V
16	** 2.62483	38.85	PK-U	32.4	-25.3	-24	21.95	54	-32.05	-	-	172	180	V
8	*** 3.71972	45.31	PK-U	33.1	-32.5	0	45.91	-	-	74	-28.09	192	108	H
8	*** 3.71972	45.31	PK-U	33.1	-32.5	-24	21.91	54	-32.09	-	-	192	108	H
9	*** 4.95993	49.05	PK-U	34.1	-31.1	0	52.05	-	-	74	-21.95	238	120	H
9	*** 4.95993	49.05	PK-U	34.1	-31.1	-24	28.05	54	-25.95	-	-	238	120	H
10	*** 7.43946	36.73	PK-U	35.8	-27.8	0	44.73	-	-	74	-29.27	165	210	H
10	*** 7.43946	36.73	PK-U	35.8	-27.8	-24	20.73	54	-33.27	-	-	165	210	H
12	** 12.39938	44.43	PK-U	38.8	-23.9	0	59.33	-	-	74	-14.67	66	111	H
12	** 12.39938	44.43	PK-U	38.8	-23.9	-24	35.33	54	-18.67	-	-	66	111	H
17	*** 3.72032	43.35	PK-U	33.1	-32.5	0	43.95	-	-	74	-30.05	208	199	V
17	*** 3.72032	43.35	PK-U	33.1	-32.5	-24	19.95	54	-34.05	-	-	208	199	V
18	*** 4.95971	46.33	PK-U	34.1	-31	0	49.43	-	-	74	-24.57	189	111	V
18	*** 4.95971	46.33	PK-U	34.1	-31	-24	25.43	54	-28.57	-	-	189	111	V
20	*** 7.44064	40.48	PK-U	35.8	-27.8	0	48.48	-	-	74	-25.52	233	218	V
20	*** 7.44064	40.48	PK-U	35.8	-27.8	-24	24.48	54	-29.52	-	-	233	218	V
22	*** 12.39944	48.65	PK-U	38.8	-23.9	0	63.55	-	-	74	-10.45	21	101	V
22	*** 12.39944	48.65	PK-U	38.8	-23.9	-24	39.55	54	-14.45	-	-	21	101	V
5	2.10052	40.49	Pk	31.2	-22.9	0	48.79	-	-	-	-	0-360	199	H
15	2.10052	36.62	Pk	31.2	-22.9	0	44.92	-	-	-	-	0-360	199	V
6	2.40023	34.78	Pk	31.9	-23.9	0	42.78	-	-	-	-	0-360	101	H
7	2.43991	34.32	Pk	32.1	-24.2	0	42.22	-	-	-	-	0-360	199	H
19	5.76016	35.32	Pk	34.8	-30	0	40.12	-	-	-	-	0-360	199	V
11	9.91872	43.82	Pk	37.2	-25.5	0	55.52	-	-	-	-	0-360	199	H
21	9.91872	41.52	Pk	37.2	-25.5	0	53.22	-	-	-	-	0-360	101	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

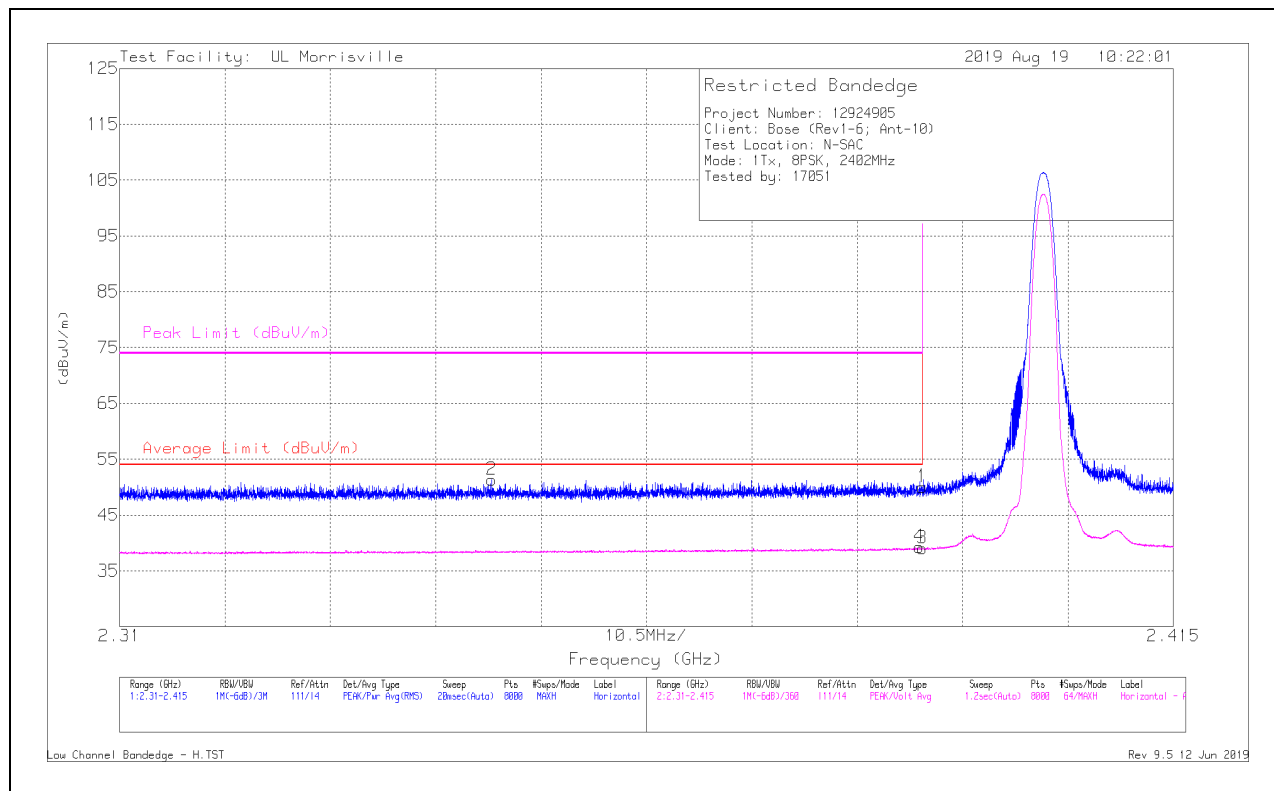
PK-U - U-NII: Maximum Peak

Pk - Peak detector

9.1.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



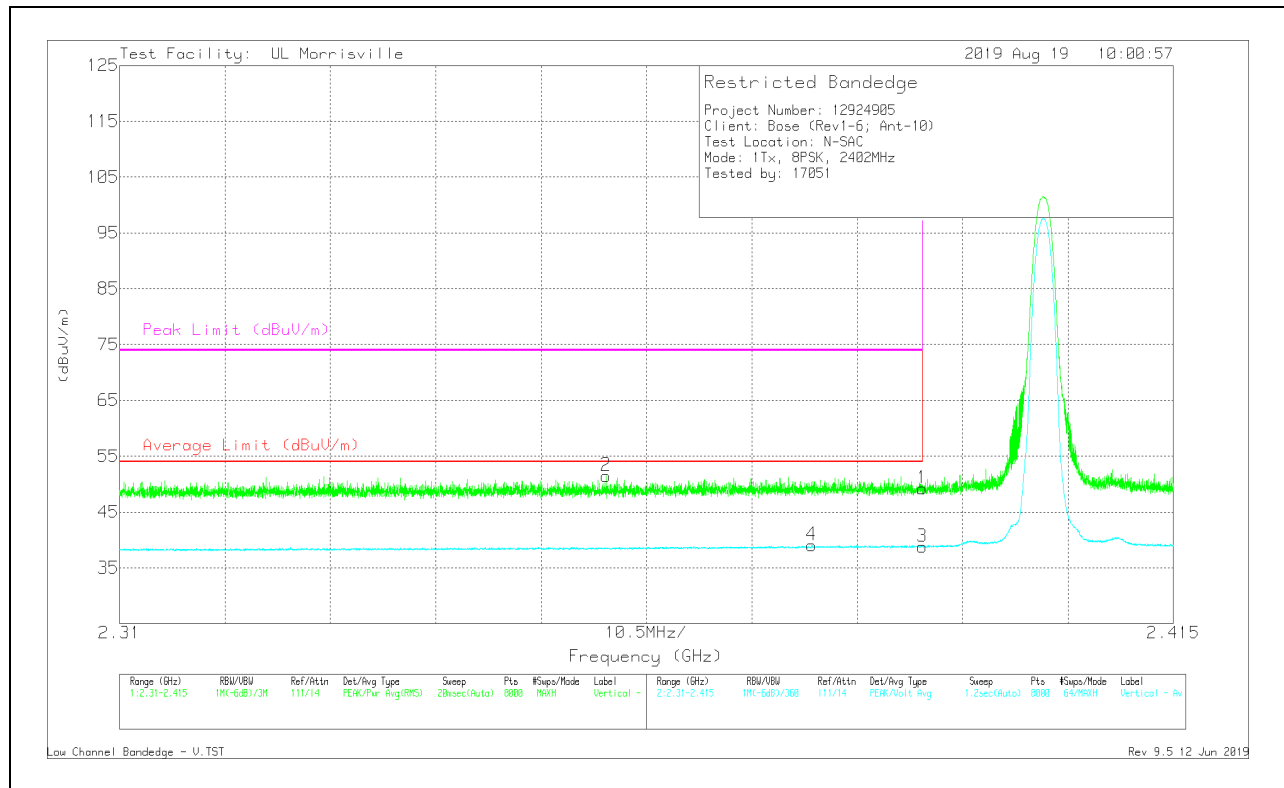
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 AF (dBuV/m)	Amp/Cbl/Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	*** 2.39	42.51	Pk	32	-24.5	0	50.01	-	-	74	-23.99	349	144	H
	*** 2.39	42.51	Pk	32	-24.5	-24	26.01	54	-27.99	-	-	349	144	H
2	*** 2.34708	44.14	Pk	31.8	-24.6	0	51.34	-	-	74	-22.66	349	144	H
	*** 2.34708	44.14	Pk	31.8	-24.6	-24	27.34	54	-26.66	-	-	349	144	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 AF (dBuV/m)	Amp/Cbl/Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	*** 2.39	41.71	Pk	32	-24.5	0	49.21	-	-	74	-24.79	236	397	V
	*** 2.39	41.71	Pk	32	-24.5	-24	25.21	54	-28.79	-	-	236	397	V
2	*** 2.35847	44.29	Pk	31.8	-24.6	0	51.49	-	-	74	-22.51	236	397	V
	*** 2.35847	44.29	Pk	31.8	-24.6	-24	27.49	54	-26.51	-	-	236	397	V

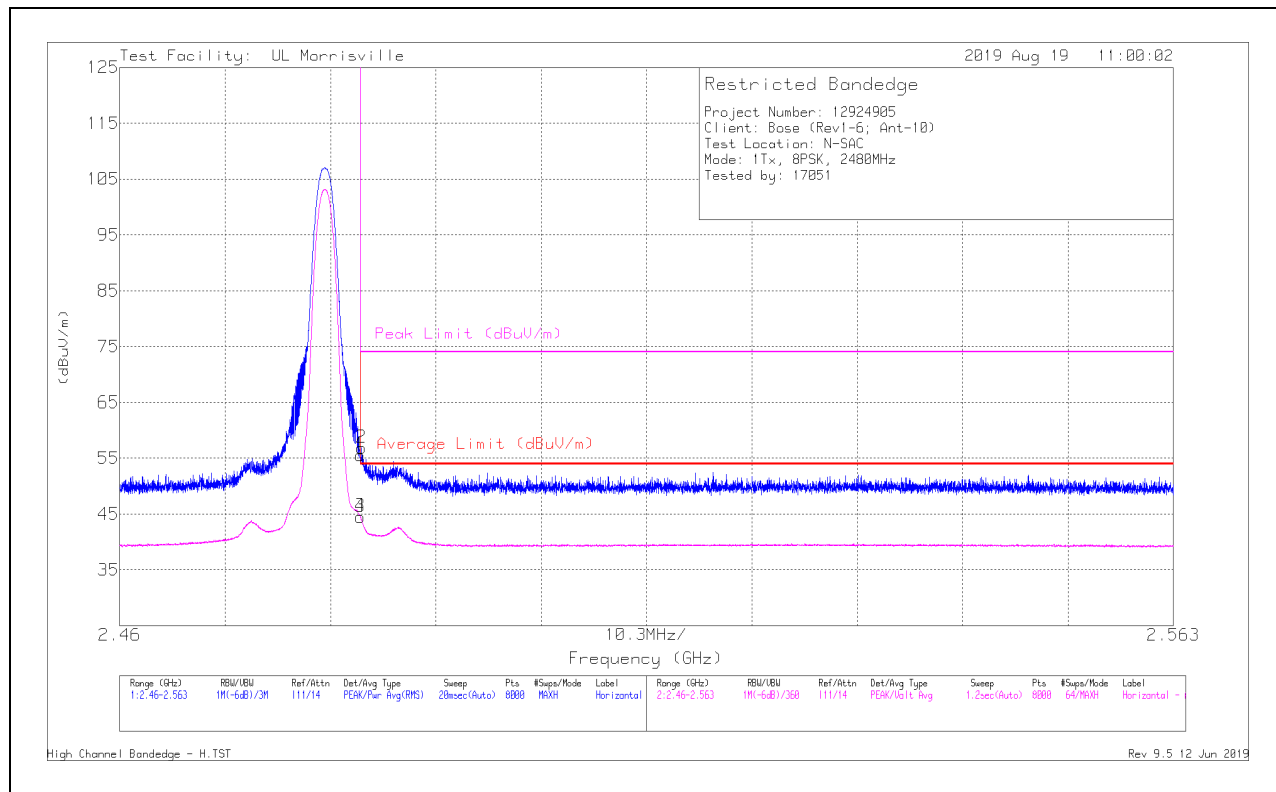
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

BANEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



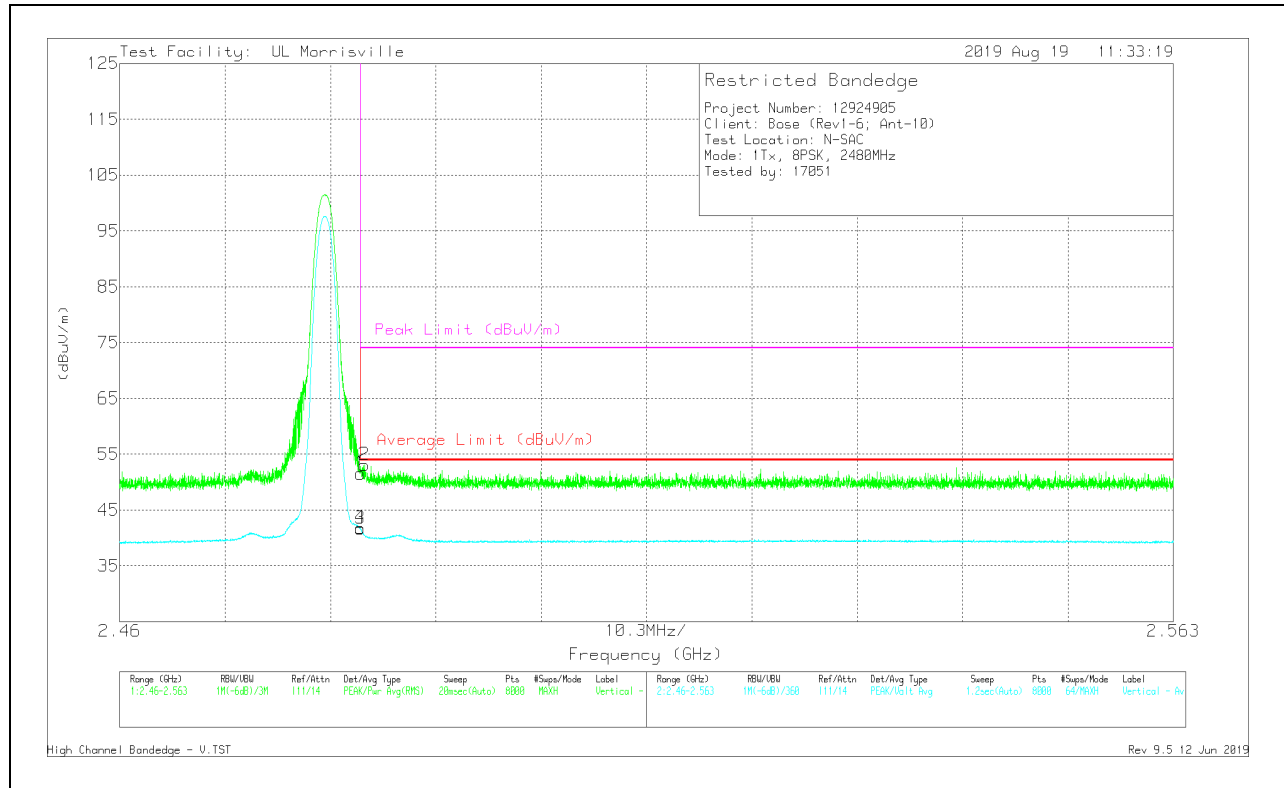
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 AF (dBuV/m)	Amp/Cbl/Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.4835	47.48	Pk	32.4	-24.3	0	55.58	-	-	74	-18.42	177	112	H
1	* ** 2.4835	47.48	Pk	32.4	-24.3	-24	31.58	54	-22.42	-	-	177	112	H
2	* ** 2.48363	48.76	Pk	32.4	-24.3	0	56.86	-	-	74	-17.14	177	112	H
2	* ** 2.48363	48.76	Pk	32.4	-24.3	-24	32.86	54	-21.14	-	-	177	112	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 AF (dBuV/m)	Amp/Cbl/Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.4835	43.46	Pk	32.4	-24.3	0	51.56	-	-	74	-22.44	52	323	V
1	* ** 2.4835	43.46	Pk	32.4	-24.3	-24	27.56	54	-26.44	-	-	52	323	V
2	* ** 2.48391	44.99	Pk	32.4	-24.3	0	53.09	-	-	74	-20.91	52	323	V
2	* ** 2.48391	44.99	Pk	32.4	-24.3	-24	29.09	54	-24.91	-	-	52	323	V

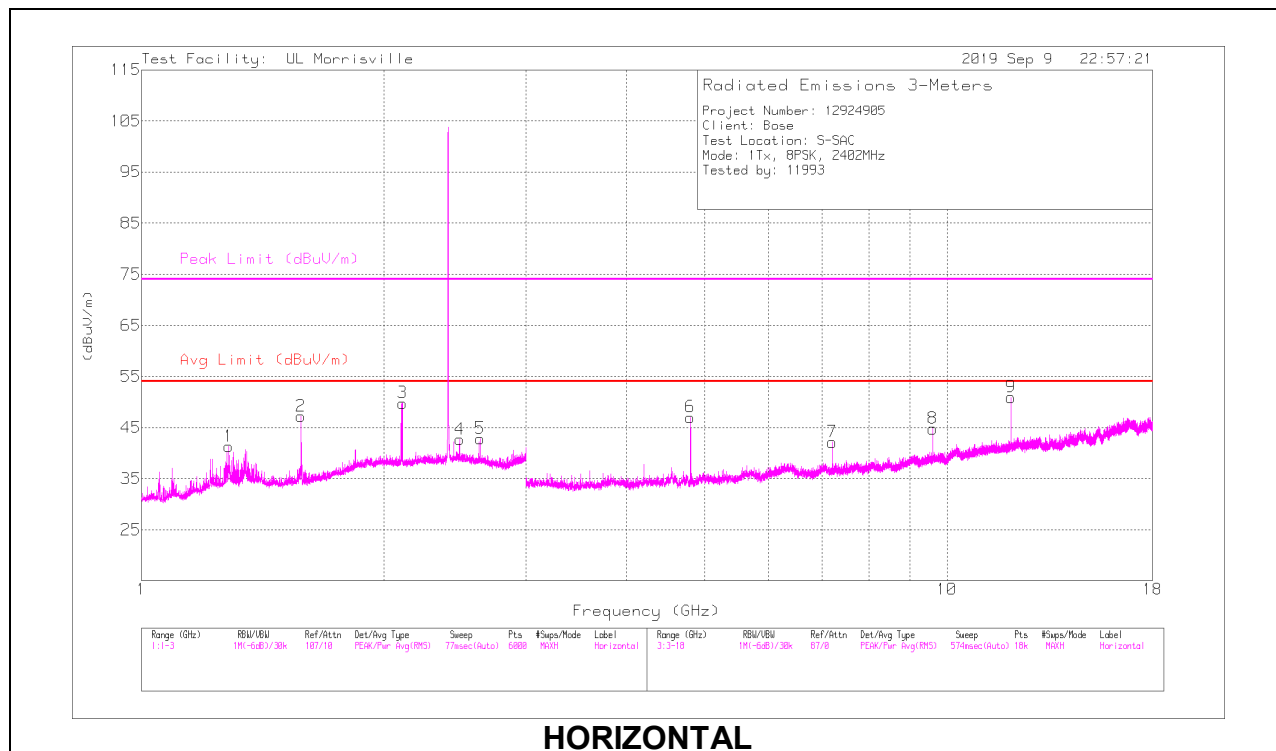
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

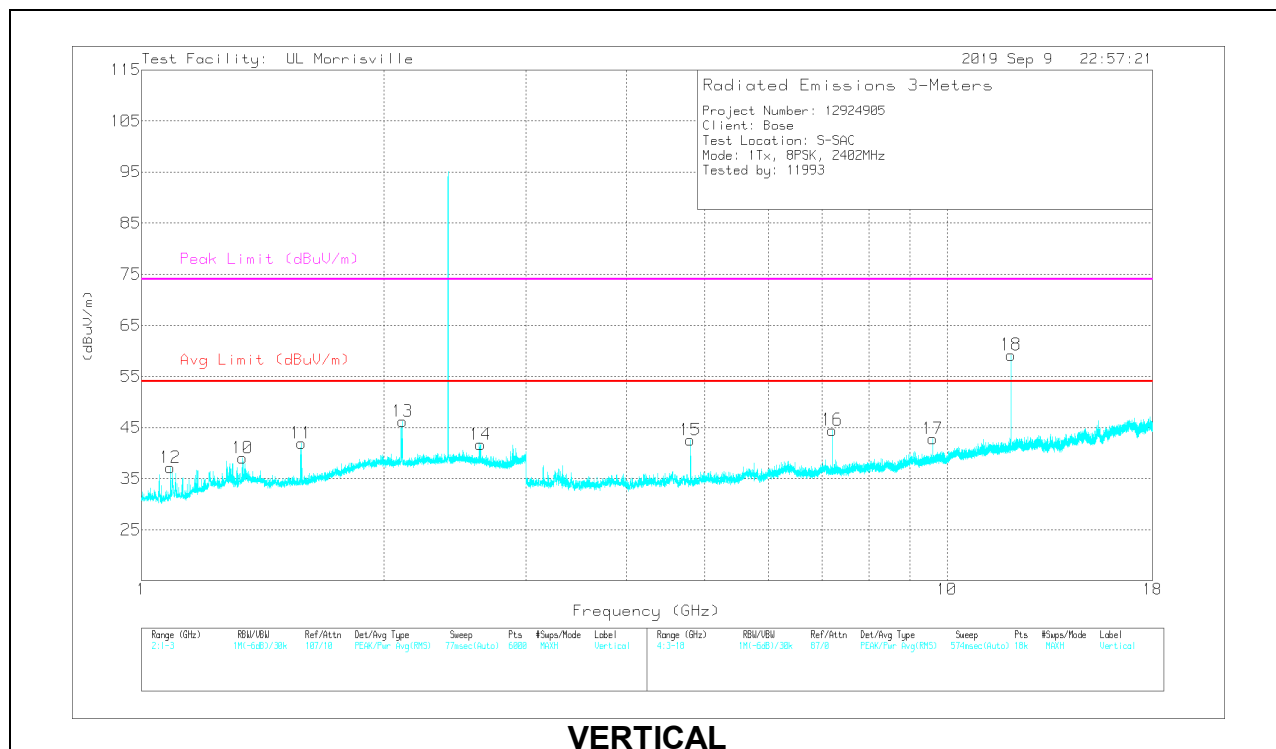
Pk - Peak detector

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Fitr/Pad (dB)	DCCF (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.28468	42.98	PK-U	29.1	-23.2	0	48.88	-	-	74	-25.12	166	340	H
1	* 1.28468	42.98	PK-U	29.1	-23.2	-24	24.88	54	-29.12	-	-	166	340	H
2	*** 1.57707	44.53	PK-U	27.9	-22.2	0	50.23	-	-	74	-23.77	111	213	H
2	*** 1.57707	44.53	PK-U	27.9	-22.2	-24	26.23	54	-27.77	-	-	111	213	H
5	** 2.63459	38.88	PK-U	32.4	-25.3	0	45.98	-	-	74	-28.02	166	346	H
5	** 2.63459	38.88	PK-U	32.4	-25.3	-24	21.98	54	-32.02	-	-	166	346	H
10	*** 1.33663	37.14	PK-U	29	-23	0	43.14	-	-	74	-30.86	22	109	V
10	*** 1.33663	37.14	PK-U	29	-23	-24	19.14	54	-34.86	-	-	22	109	V
11	*** 1.57919	48.08	PK-U	27.9	-22.2	0	53.78	-	-	74	-20.22	96	319	V
11	*** 1.57919	48.08	PK-U	27.9	-22.2	-24	29.78	54	-24.22	-	-	96	319	V
12	*** 1.08401	38.63	PK-U	27.5	-24.4	0	41.73	-	-	74	-32.27	127	221	V
12	*** 1.08401	38.63	PK-U	27.5	-24.4	-24	17.73	54	-36.27	-	-	127	221	V
14	** 2.63585	43.23	PK-U	32.5	-25.3	0	50.43	-	-	74	-23.57	185	238	V
14	** 2.63585	43.23	PK-U	32.5	-25.3	-24	26.43	54	-27.57	-	-	185	238	V
6	*** 4.80371	48.06	PK-U	34.2	-31	0	51.26	-	-	74	-22.74	9	126	H
6	*** 4.80371	48.06	PK-U	34.2	-31	-24	27.26	54	-26.74	-	-	9	126	H
9	*** 12.0101	42.88	PK-U	38.7	-23.7	0	57.88	-	-	74	-16.12	52	104	H
9	*** 12.0101	42.88	PK-U	38.7	-23.7	-24	33.88	54	-20.12	-	-	52	104	H
15	*** 4.80413	44.72	PK-U	34.2	-31	0	47.92	-	-	74	-26.08	156	260	V
15	*** 4.80413	44.72	PK-U	34.2	-31	-24	23.92	54	-30.08	-	-	156	260	V
18	*** 12.01095	46.64	PK-U	38.7	-23.7	0	61.64	-	-	74	-12.36	44	102	V
18	*** 12.01095	46.64	PK-U	38.7	-23.7	-24	37.64	54	-16.36	-	-	44	102	V
3	2.10885	41.59	Pk	31.2	-23	0	49.79	-	-	-	-	0-360	101	H
13	2.10919	37.97	Pk	31.2	-23	0	46.17	-	-	-	-	0-360	199	V
4	2.48258	34.86	Pk	32.3	-24.5	0	42.66	-	-	-	-	0-360	199	H
7	7.20524	34.44	Pk	35.7	-28	0	42.14	-	-	-	-	0-360	101	H
16	7.20607	36.8	Pk	35.7	-28	0	44.5	-	-	-	-	0-360	101	V
8	9.60704	33.68	Pk	37.1	-26	0	44.78	-	-	-	-	0-360	199	H
17	9.60787	31.72	Pk	37.1	-26	0	42.82	-	-	-	-	0-360	101	V

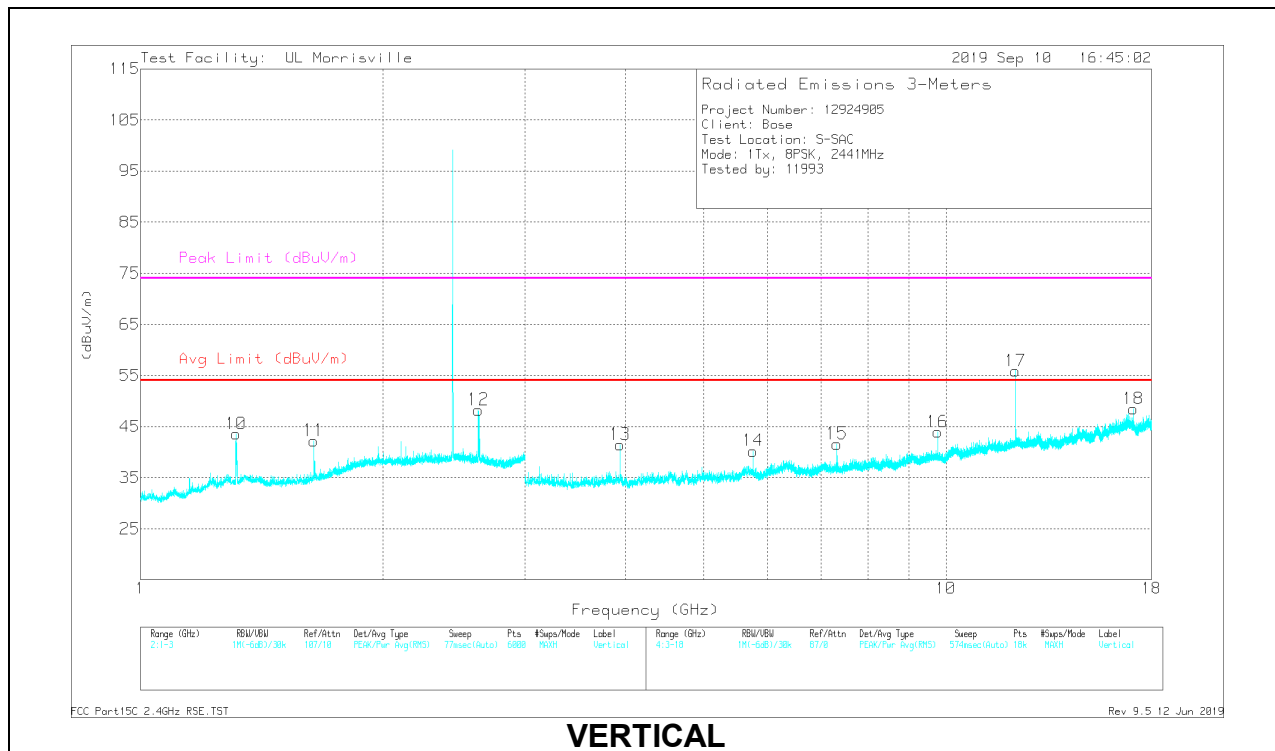
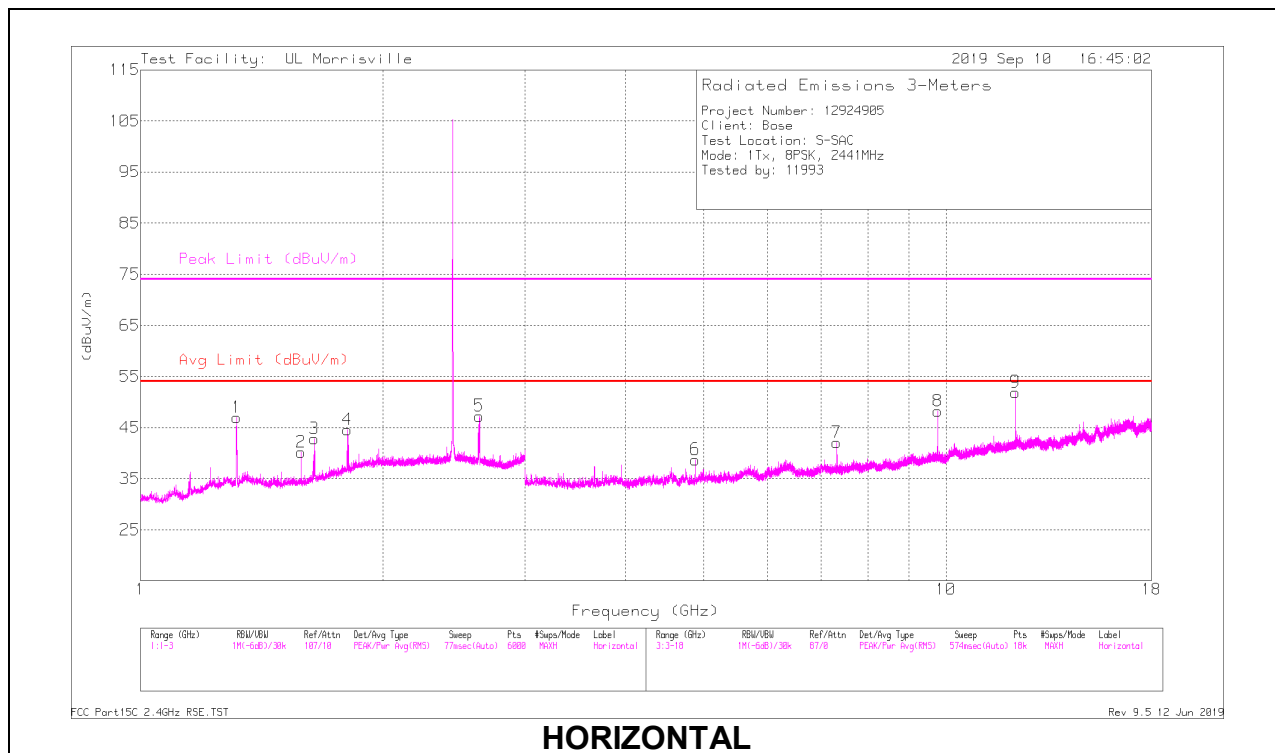
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

PK-U - U-NII: Maximum Peak

Pk - Peak detector

MID CHANNEL RESULTS



RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	DCCF (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	*** 1.31783	47.57	PK-U	28.9	-23.1	0	53.37	-	-	74	-20.63	182	192	H
1	*** 1.31783	47.57	PK-U	28.9	-23.1	-24	29.37	54	-24.63	-	-	182	192	H
2	*** 1.58075	50.09	PK-U	27.9	-22.3	0	55.69	-	-	74	-18.31	138	175	H
2	*** 1.58075	50.09	PK-U	27.9	-22.3	-24	31.69	54	-22.31	-	-	138	175	H
4	** 1.80576	45.33	PK-U	30.2	-22.3	0	53.23	-	-	74	-20.77	187	184	H
4	** 1.80576	45.33	PK-U	30.2	-22.3	-24	29.23	54	-24.77	-	-	187	184	H
5	** 2.63381	48.91	PK-U	32.4	-25.3	0	56.01	-	-	74	-17.99	269	183	H
5	** 2.63381	48.91	PK-U	32.4	-25.3	-24	32.01	54	-21.99	-	-	269	183	H
10	*** 1.3129	43.83	PK-U	28.8	-23.1	0	49.53	-	-	74	-24.47	243	195	V
10	*** 1.3129	43.83	PK-U	28.8	-23.1	-24	25.53	54	-28.47	-	-	243	195	V
12	** 2.62601	49.2	PK-U	32.4	-25.3	0	56.3	-	-	74	-17.7	240	182	V
12	** 2.62601	49.2	PK-U	32.4	-25.3	-24	32.3	54	-21.7	-	-	240	182	V
6	*** 4.88213	42.46	PK-U	34	-30.6	0	45.86	-	-	74	-28.14	40	239	H
6	*** 4.88213	42.46	PK-U	34	-30.6	-24	21.86	54	-32.14	-	-	40	239	H
7	*** 7.32361	40.76	PK-U	35.7	-27.5	0	48.96	-	-	74	-25.04	196	248	H
7	*** 7.32361	40.76	PK-U	35.7	-27.5	-24	24.96	54	-29.04	-	-	196	248	H
9	*** 12.20588	43.51	PK-U	38.9	-23.8	0	58.61	-	-	74	-15.39	73	102	H
9	*** 12.20588	43.51	PK-U	38.9	-23.8	-24	34.61	54	-19.39	-	-	73	102	H
13	*** 3.93879	50.49	PK-U	33.4	-31.7	0	52.19	-	-	74	-21.81	246	121	V
13	*** 3.93879	50.49	PK-U	33.4	-31.7	-24	28.19	54	-25.81	-	-	246	121	V
15	*** 7.32316	39.81	PK-U	35.7	-27.5	0	48.01	-	-	74	-25.99	223	110	V
15	*** 7.32316	39.81	PK-U	35.7	-27.5	-24	24.01	54	-29.99	-	-	223	110	V
17	*** 12.20612	40.66	PK-U	38.9	-23.8	0	55.76	-	-	74	-18.24	11	112	V
17	*** 12.20612	40.66	PK-U	38.9	-23.8	-24	31.76	54	-22.24	-	-	11	112	V
11	1.64044	36.04	Pk	28.3	-22.1	0	42.24	-	-	-	-	0-360	101	V
3	1.64311	36.6	Pk	28.3	-22.1	0	42.8	-	-	-	-	0-360	199	H
14	5.76016	35.44	Pk	34.8	-30	0	40.24	-	-	-	-	0-360	101	V
16	9.76371	32.48	Pk	37.1	-25.6	0	43.98	-	-	-	-	0-360	199	V
8	9.76455	36.72	Pk	37.1	-25.6	0	48.22	-	-	-	-	0-360	101	H
18	17.08662	29.39	Pk	41.5	-22.4	0	48.49	-	-	-	-	0-360	101	V

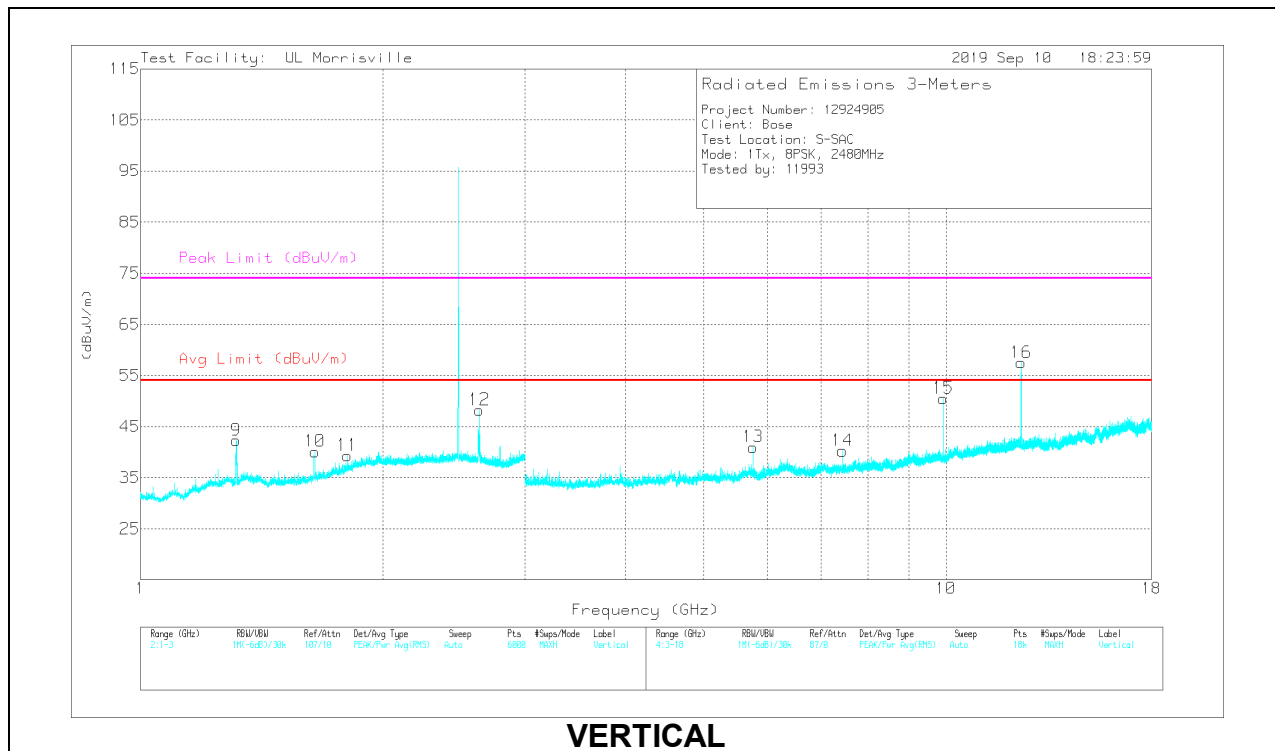
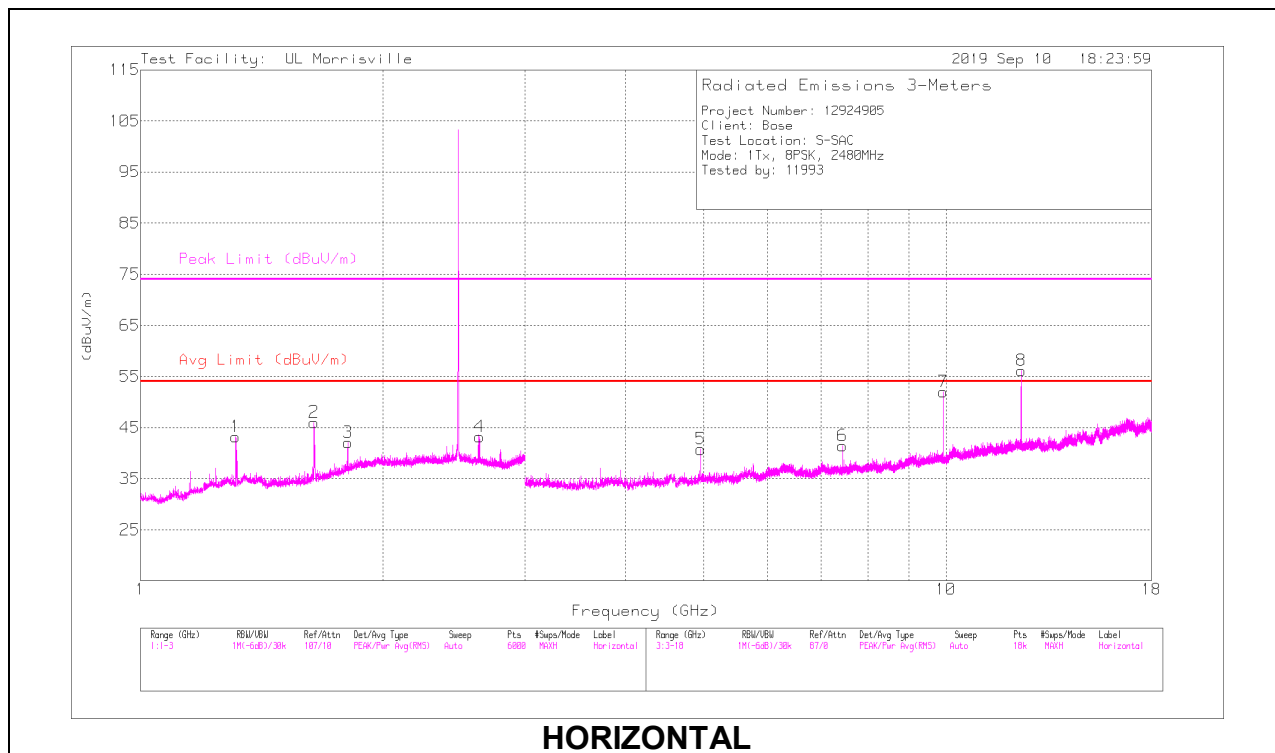
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

PK-U - U-NII: Maximum Peak

Pk - Peak detector

HIGH CHANNEL RESULTS



RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	DCCF	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	*** 1.31235	47.8	PK-U	28.8	-23.1	0	53.5	-	-	74	-20.5	182	200	H
1	*** 1.31235	47.8	PK-U	28.8	-23.1	-24	29.5	54	-24.5	-	-	182	200	H
3	** 1.80619	44.16	PK-U	30.2	-22.3	0	52.06	-	-	74	-21.94	174	176	H
3	** 1.80619	44.16	PK-U	30.2	-22.3	-24	28.06	54	-25.94	-	-	174	176	H
4	** 2.63573	48.13	PK-U	32.5	-25.3	0	55.33	-	-	74	-18.67	318	116	H
4	** 2.63573	48.13	PK-U	32.5	-25.3	-24	31.33	54	-22.67	-	-	318	116	H
10	* 1.64653	45.07	PK-U	28.3	-22.1	0	51.27	-	-	74	-22.73	229	240	V
10	* 1.64653	45.07	PK-U	28.3	-22.1	-24	27.27	54	-26.73	-	-	229	240	V
11	** 1.80838	42.73	PK-U	30.2	-22.3	0	50.63	-	-	74	-23.37	181	274	V
11	** 1.80838	42.73	PK-U	30.2	-22.3	-24	26.63	54	-27.37	-	-	181	274	V
12	** 2.63556	51.36	PK-U	32.5	-25.3	0	58.56	-	-	74	-15.44	239	209	V
12	** 2.63556	51.36	PK-U	32.5	-25.3	-24	34.56	54	-19.44	-	-	239	209	V
9	*** 1.31271	42.11	PK-U	28.8	-23.1	0	47.81	-	-	74	-26.19	216	321	V
9	*** 1.31271	42.11	PK-U	28.8	-23.1	-24	23.81	54	-30.19	-	-	216	321	V
5	*** 4.95988	46.14	PK-U	34.1	-31.1	0	49.14	-	-	74	-24.86	188	136	H
5	*** 4.95988	46.14	PK-U	34.1	-31.1	-24	25.14	54	-28.86	-	-	188	136	H
6	*** 7.43936	38.65	PK-U	35.8	-27.8	0	46.65	-	-	74	-27.35	217	295	H
6	*** 7.43936	38.65	PK-U	35.8	-27.8	-24	22.65	54	-31.35	-	-	217	295	H
8	*** 12.4002	42.96	PK-U	38.8	-23.9	0	57.86	-	-	74	-16.14	82	104	H
8	*** 12.4002	42.96	PK-U	38.8	-23.9	-24	33.86	54	-20.14	-	-	82	104	H
14	*** 7.43967	38.73	PK-U	35.8	-27.8	0	46.73	-	-	74	-27.27	187	193	V
14	*** 7.43967	38.73	PK-U	35.8	-27.8	-24	22.73	54	-31.27	-	-	187	193	V
16	*** 12.39934	43.49	PK-U	38.8	-23.9	0	58.39	-	-	74	-15.61	15	244	V
16	*** 12.39934	43.49	PK-U	38.8	-23.9	-24	34.39	54	-19.61	-	-	15	244	V
2	1.64211	39.81	Pk	28.3	-22.1		46.01	-	-	-	-	0-360	199	H
13	5.76016	36.2	Pk	34.8	-30		41	-	-	-	-	0-360	101	V
15	9.91955	38.84	Pk	37.2	-25.5		50.54	-	-	-	-	0-360	199	V
7	9.92039	40.31	Pk	37.2	-25.5		52.01	-	-	-	-	0-360	101	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

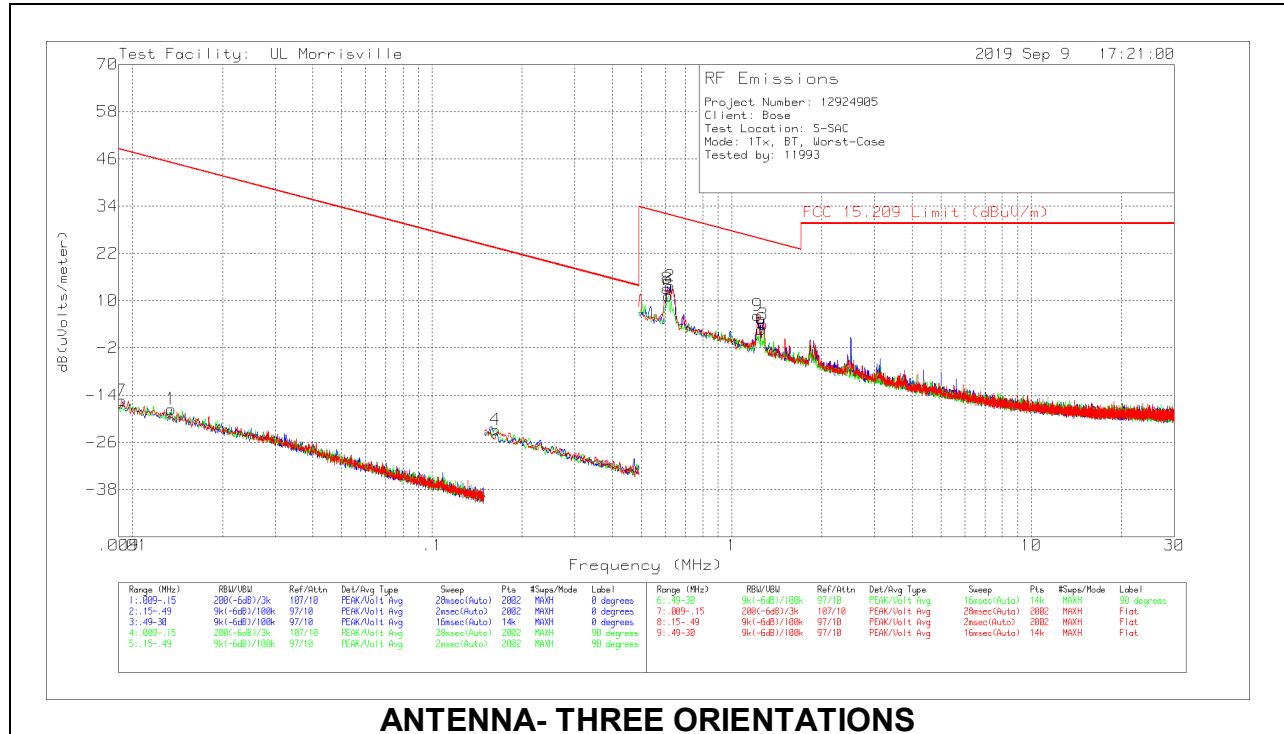
PK-U - U-NII: Maximum Peak

Pk - Peak detector

9.2. WORST CASE BELOW 30MHZ

SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)

Note: All measurements were made at a test distance of 3 m. The measured data was extrapolated from the test distance (3m) to the specification distance (300 m from 9-490 kHz and 30 m from 490 kHz – 30 MHz) to clearly show the relative levels of fundamental and spurious emissions and demonstrate compliance with the requirement that the level of any spurious emissions be below the level of the intentionally transmitted signal. The extrapolation factor for the limits were $40 \cdot \log(\text{test distance} / \text{specification distance})$.



ANTENNA- THREE ORIENTATIONS

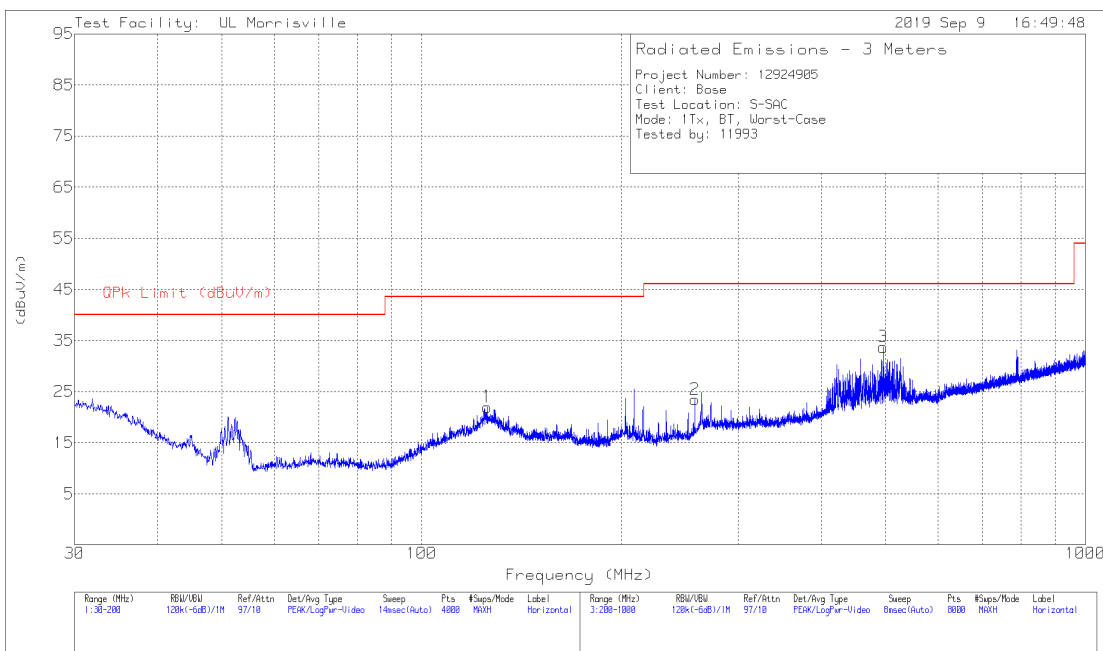
Below 30MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 AF (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uV/m)	FCC 15.209 QP/AV Limit (dBuV/m)	FCC 15.209 PK Limit (dBuV/m)	Worst-Case Margin (dB)	Azimuth (Degs)	Antenna Face
7	.00921	45.74	Pk	18.8	.1	-80	-15.36	48.32	68.32	-63.68	0-360	Flat
1	.01348	45.66	Pk	16.7	.1	-80	-17.54	45.01	65.01	-62.55	0-360	On
4	.16326	46.11	Pk	11	.1	-80	-22.79	23.35	43.35	-46.14	0-360	Off
8	.61016	41.97	Pk	11	.1	-40	13.07	31.9	-	-18.83	0-360	Flat
5	.61437	40.01	Pk	11	.1	-40	11.11	31.84	-	-20.73	0-360	Off
2	.62491	42.62	Pk	11	.1	-40	13.72	31.69	-	-17.97	0-360	On
9	1.22148	34.95	Pk	11.1	.2	-40	6.25	25.87	-	-19.62	0-360	Flat
6	1.25731	31.48	Pk	11.1	.2	-40	2.78	25.62	-	-22.84	0-360	Off
3	1.27628	32.64	Pk	11.1	.2	-40	3.94	25.49	-	-21.55	0-360	On

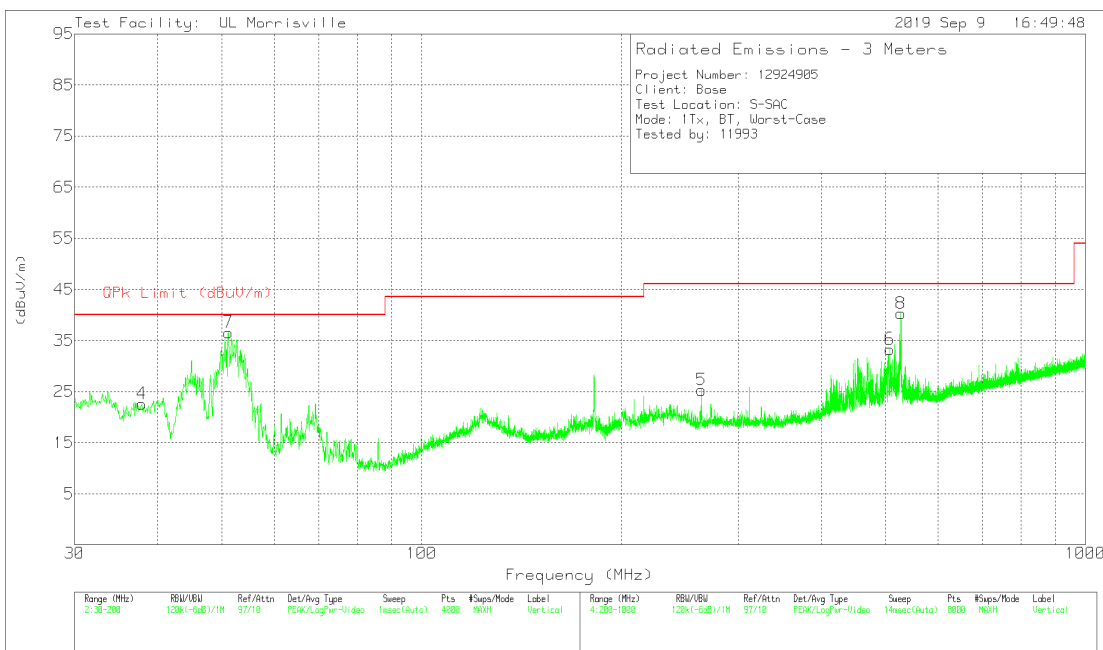
Pk - Peak detector

9.3. WORST CASE BELOW 1 GHZ

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION)



HORIZONTAL



VERTICAL

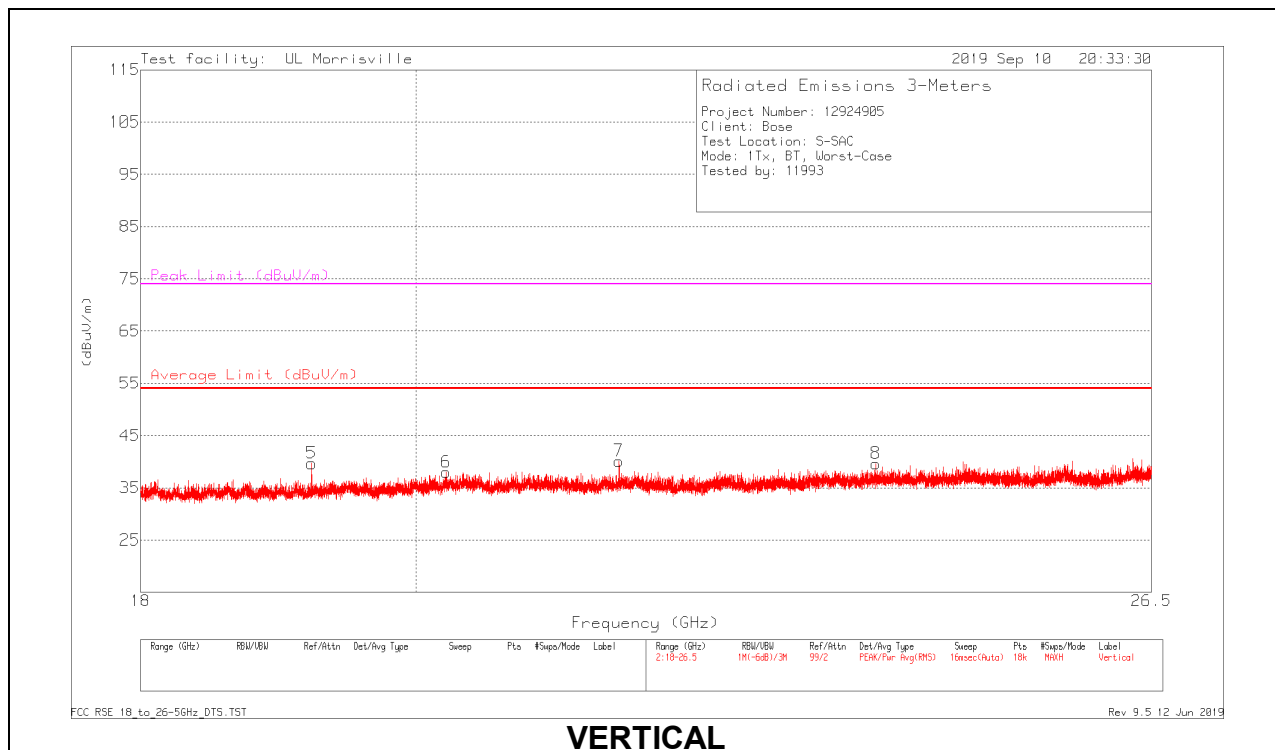
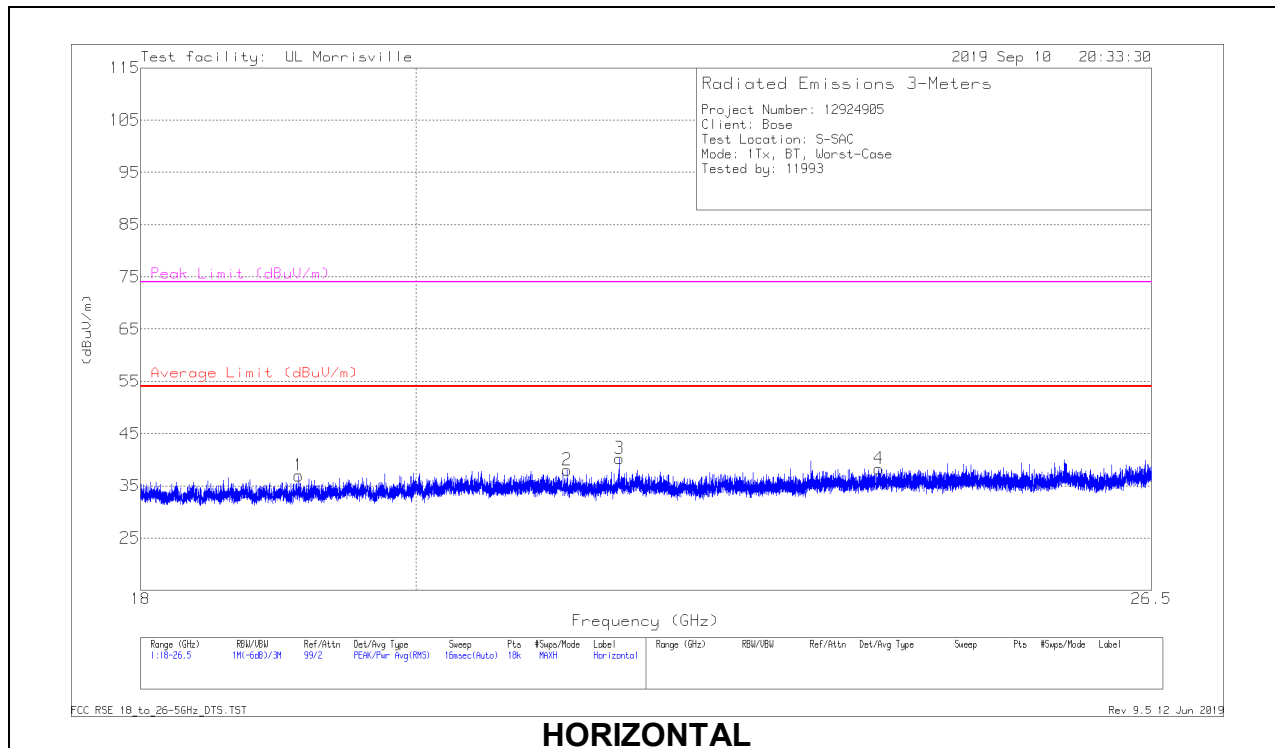
Below 1GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0074 AF (dB/m)	Cbl/Amp	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 125.5647	32.79	Pk	19.9	-30.7	21.99	43.52	-21.53	0-360	198	H
4	* ** 37.907	32.8	Pk	21.5	-31.7	22.6	40	-17.4	0-360	101	V
2	* ** 258.1076	35.37	Pk	17.9	-29.8	23.47	46.02	-22.55	0-360	101	H
3	** 496.0385	38.6	Pk	23.8	-28.7	33.7	46.02	-12.32	0-360	198	H
5	* ** 264.0083	36.49	Pk	18.7	-29.9	25.29	46.02	-20.73	0-360	101	V
6	** 507.0399	38.39	Pk	23.7	-28.8	33.29	46.02	-12.73	0-360	101	V
7	51.1251	51.22	Qp	13.8	-31.5	33.52	40	-6.48	75	111	V
8	527.1686	33.1	Qp	23.9	-28.7	28.3	46.02	-17.72	133	111	V

Pk - Peak detector

9.4. WORST CASE 18-26 GHZ

SPURIOUS EMISSIONS 18-26 GHz (WORST-CASE CONFIGURATION)



18 – 26GHz DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0076 AF (dB/m)	Cbl/Amp (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 19.12159	43.07	Pk	32.8	-38.9	36.97	54	-17.03	74	-37.03	0-360	298	H
2	* ** 21.19145	43.35	Pk	33	-38.3	38.05	54	-15.95	74	-35.95	0-360	298	H
4	* ** 23.87665	41.61	Pk	34	-37.3	38.31	54	-15.69	74	-35.69	0-360	298	H
5	* ** 19.21746	45.88	Pk	32.6	-38.8	39.68	54	-14.32	74	-34.32	0-360	102	V
6	* ** 20.23279	43.6	Pk	32.9	-38.5	38	54	-16	74	-36	0-360	252	V
8	* ** 23.84738	42.95	Pk	34	-37.3	39.65	54	-14.35	74	-34.35	0-360	202	V
7	21.61648	44.93	Pk	33.3	-38.1	40.13	54	-13.87	74	-33.87	0-360	102	V
3	21.61931	45.07	Pk	33.3	-38.1	40.27	54	-13.73	74	-33.73	0-360	100	H

Pk - Peak detector

10. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)
RSS-Gen 8.8

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10.

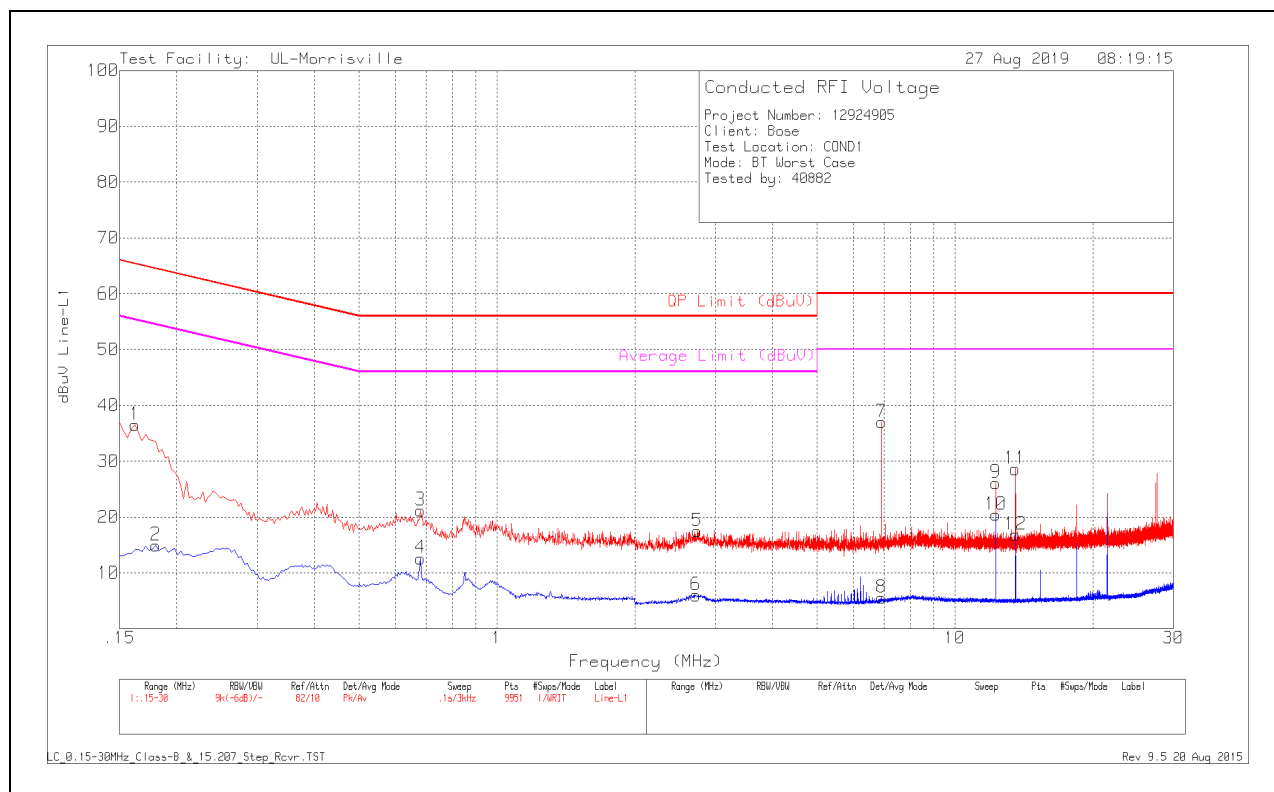
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

10.1.1. AC Power Line Norm

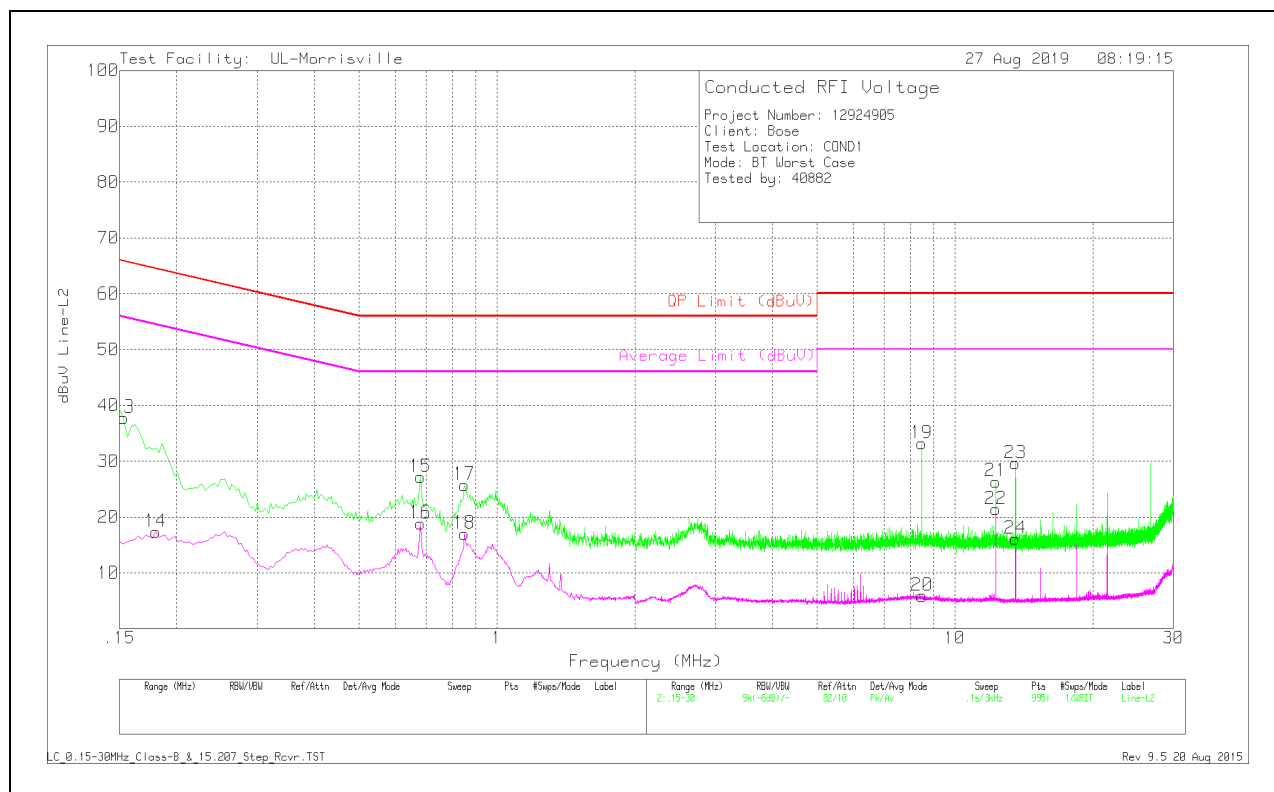
LINE 1 RESULTS



Range 1: Line-L1 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
1	.162	26.29	Pk	.2	10	36.49	65.36	-28.87	-	-
2	.18	4.73	Av	.2	10	14.93	-	-	54.49	-39.56
3	.681	11.1	Pk	.1	10	21.2	56	-34.8	-	-
4	.681	2.52	Av	.1	10	12.62	-	-	46	-33.38
5	2.736	7.36	Pk	0	10.1	17.46	56	-38.54	-	-
6	2.718	-4.1	Av	0	10.1	6	-	-	46	-40
7	6.924	26.7	Pk	.1	10.2	37	60	-23	-	-
8	6.924	-4.72	Av	.1	10.2	5.58	-	-	50	-44.42
9	12.288	15.63	Pk	.1	10.4	26.13	60	-33.87	-	-
10	12.288	9.95	Av	.1	10.4	20.45	-	-	50	-29.55
11	13.56	18.11	Pk	.1	10.4	28.61	60	-31.39	-	-
12	13.56	6.33	Av	.1	10.4	16.83	-	-	50	-33.17

Pk - Peak detector
Av - Average detector

LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
13	.153	27.59	Pk	.2	10	37.79	65.84	-28.05	-	-
14	.18	7.12	Av	.2	10	17.32	-	-	54.49	-37.17
15	.681	17.16	Pk	0	10	27.16	56	-28.84	-	-
16	.681	8.88	Av	0	10	18.88	-	-	46	-27.12
17	.849	15.76	Pk	0	10	25.76	56	-30.24	-	-
18	.849	7.02	Av	0	10	17.02	-	-	46	-28.98
19	8.466	22.8	Pk	.1	10.3	33.2	60	-26.8	-	-
20	8.481	-4.53	Av	.1	10.3	5.87	-	-	50	-44.13
21	12.288	15.89	Pk	.1	10.4	26.39	60	-33.61	-	-
22	12.288	10.88	Av	.1	10.4	21.38	-	-	50	-28.62
23	13.56	19.16	Pk	.1	10.4	29.66	60	-30.34	-	-
24	13.56	5.62	Av	.1	10.4	16.12	-	-	50	-33.88

Pk - Peak detector
Av - Average detector

11. SETUP PHOTOS

Please refer to 12924905-EP1 for setup photos

END OF TEST REPORT