



CERTIFICATION TEST REPORT

Report Number: R13158070-E4

Applicant : Braun GMBH
T-QTA Frankfurter Strasses 145
Kronberg TS, D-61476
Germany

Model : 3783

FCC ID : 2AG9A51910

EUT Description : Wireless Toothbrush Charging Base

Test Standard(s) : FCC 47 CFR PART 15 SUBPART C

Date Of Issue:

2020-03-31

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REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
1	2020-03-20	Initial Issue	Cristian Melara
2	2020-03-31	Revised 8PSK maximum output power in Section 5.2.	Brian T. Kiewra

TABLE OF CONTENTS

REPORT REVISION HISTORY	2
TABLE OF CONTENTS	3
1. ATTESTATION OF TEST RESULTS	5
2. TEST METHODOLOGY	6
3. FACILITIES AND ACCREDITATION	6
4. CALIBRATION AND UNCERTAINTY	7
4.1. <i>MEASURING INSTRUMENT CALIBRATION</i>	<i>7</i>
4.2. <i>SAMPLE CALCULATION</i>	<i>7</i>
4.3. <i>MEASUREMENT UNCERTAINTY</i>	<i>7</i>
5. EQUIPMENT UNDER TEST	8
5.1. <i>EUT DESCRIPTION</i>	<i>8</i>
5.2. <i>MAXIMUM OUTPUT POWER</i>	<i>8</i>
5.3. <i>DESCRIPTION OF AVAILABLE ANTENNAS</i>	<i>8</i>
5.4. <i>SOFTWARE AND FIRMWARE</i>	<i>8</i>
5.5. <i>WORST-CASE CONFIGURATION AND MODE</i>	<i>9</i>
5.6. <i>DESCRIPTION OF TEST SETUP</i>	<i>10</i>
6. TEST AND MEASUREMENT EQUIPMENT	11
7. MEASUREMENT METHODS	14
8. ANTENNA PORT TEST RESULTS	15
8.1. <i>ON TIME AND DUTY CYCLE</i>	<i>15</i>
8.2. <i>20 dB AND 99% BANDWIDTH</i>	<i>16</i>
8.2.1. <i>BLUETOOTH BASIC DATA RATE GFSK MODULATION</i>	<i>16</i>
8.2.1. <i>BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION</i>	<i>17</i>
8.3. <i>HOPPING FREQUENCY SEPARATION</i>	<i>18</i>
8.3.1. <i>BLUETOOTH BASIC DATA RATE GFSK MODULATION</i>	<i>19</i>
8.3.2. <i>BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION</i>	<i>20</i>
8.4. <i>NUMBER OF HOPPING CHANNELS</i>	<i>21</i>
8.4.1. <i>BLUETOOTH BASIC DATA RATE GFSK MODULATION</i>	<i>22</i>
8.4.2. <i>BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION</i>	<i>24</i>
8.5. <i>AVERAGE TIME OF OCCUPANCY</i>	<i>26</i>
8.5.1. <i>BLUETOOTH BASIC DATA RATE GFSK MODULATION</i>	<i>26</i>
8.5.2. <i>BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION</i>	<i>28</i>
8.6. <i>OUTPUT POWER</i>	<i>30</i>

8.6.1.	BLUETOOTH BASIC DATA RATE GFSK MODULATION	30
8.6.2.	BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION.....	31
8.6.3.	BLUETOOTH ENHANCED DATA RATE DQPSK MODULATION	31
8.7.	<i>AVERAGE POWER</i>	32
8.7.1.	BLUETOOTH BASIC DATA RATE GFSK MODULATION	32
8.7.2.	BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION.....	33
8.7.3.	BLUETOOTH ENHANCED DATA RATE DQPSK MODULATION	33
8.8.	<i>CONDUCTED SPURIOUS EMISSIONS</i>	34
8.8.1.	BLUETOOTH BASIC DATA RATE GFSK MODULATION	35
8.8.2.	BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION.....	37
9.	RADIATED TEST RESULTS	39
9.1.	<i>TRANSMITTER ABOVE 1 GHz</i>	41
9.1.1.	BLUETOOTH BASIC DATA RATE GFSK MODULATION	41
9.1.2.	BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION.....	51
9.2.	<i>WORST CASE BELOW 30MHZ</i>	61
9.3.	<i>WORST CASE BELOW 1 GHZ</i>	62
9.4.	<i>WORST CASE 18-26 GHZ</i>	64
10.	AC POWER LINE CONDUCTED EMISSIONS	66
10.1.1.	AC Power Line Norm.....	67
11.	SETUP PHOTOS	69

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Braun GMBH
T-QTA Frankfurter Strasses 145
Kronberg TS, D-61476
Germany

EUT DESCRIPTION: Wireless Toothbrush Charging Base

MODEL: 3783

SERIAL NUMBER: Charging base: BW012969000010

DATE RECEIVED: 2019-12-19

DATE TESTED: 2020-01-03 to 2020-02-28

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Complies

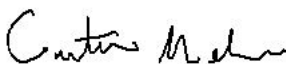
UL LLC tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

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.

This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. government.

Approved & Released For
UL LLC By:

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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.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 12 Laboratory Drive, Research Triangle Park, NC 27709, USA and 2800 Perimeter Park Dr., Suite B, Morrisville, NC 27560, 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.
☐ Chamber A RTP	☒ North Chamber
☐ Chamber C RTP	☒ South Chamber

The above test sites and facilities are covered under FCC Test Firm Registration # 703469.

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
Conducted Emissions (0.150-30MHz) - LISN	3.07 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 wireless toothbrush charging base with a BT/BLE/2.4/5GHz WLAN radio and a WPT radio that operates from 30-47 kHz. This reports covers the BT function of the device.

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	GFSK	7.00	5.01
2402 - 2480	DQPSK	7.00	5.01
2402 - 2480	8PSK	7.48	5.60

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 FPCB antenna, with a maximum gain of 2.12 dBi.

5.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was Type 3782 firmware version:V12, Type 3783 firmware version: V20.

5.5. WORST-CASE CONFIGURATION AND MODE

Radiated emissions in the range of 1-18GHz were tested with the EUT continuously transmitting on low, mid, and high channels.

AC Mains Line Conducted and radiated emissions in the ranges of 0.009-30MHz, 30-1000MHz, and 18-26GHz were tested at worst-case channel based on power and PSD.

EUT only intended to operate in one orientation. Therefore all testing performed with EUT in its intended orientation.

Worst-case data packet size tested per mode:

GFSK mode: DH3

DQPSK mode: 2-DH3

8PSK mode: 3-DH3

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Toothbrush	Braun	3765	BC811081911	USQ3765
Toothbrush	Braun	3765	BC811081913	USQ3765
Power supply	Braun	3780	Non-serialized	N/A

I/O CABLES

I/O Cable List						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	1	1	Proprietary 2 prong	2 conductor wire	<3	None

TEST SETUP

The EUT is powered by a power supply. The EUT begins charging as soon as powered up.

SETUP DIAGRAMS

Please refer to R13158070-EP2 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)

Equipment 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 June 15, 2019	NA	NA
Additional Equipment used					
s/n 181474341	Environmental Meter	Fisher Scientific	15-077-963	2018-07-27	2020-07-27
1200077	Bluetooth Tester	Rohde & Schwarz	CBT	NA	NA

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

Equipment 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
18-40 GHz					
AT0076	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2019-11-07	2020-11-07
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
S62/AMP017/CBL2 69426-001 (Effective 09/20/2019)	Gain-loss string: 18-40GHz	Huber+Suhner Miteq MegaPhase	SUCOFLEX 102EA TTA1840-35-HG NC12-K1K1-216	2019-03-21	2020-03-21
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 June 15, 2019	NA	NA

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
CDECABLE001	ANSI C63.4 1m extension cable.	UL	Per Annex B of ANSI C63.4	2019-07-10	2020-07-10
s/n 181562858	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	2019-08-20	2020-08-20
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 June 15, 2019	NA	NA

Test Equipment Used - Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
Conducted Room 2					
T177 (PRE0079253)	Spectrum Analyzer	Agilent Technologies	E4446A	2019-04-22	2020-04-22
PWS002 (PRE0137348)	Peak and Avg Power Sensor, 50MHz to 18GHz	Keysight Technologies	N1921A	2019-08-23	2020-08-23
PWM002 (PRE0137344)	RF Power Meter	Keysight Technologies	N1911A	2019-08-23	2020-08-23
SN 181474341	Environmental Meter	Fisher Scientific	15-077-963	2018-07-27	2020-07-27
SOFTEMI	EMC Software	UL	Version 2019-11-13	NA	NA
1200077	Bluetooth Tester	Rohde & Schwarz	CBT	NA	NA

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.

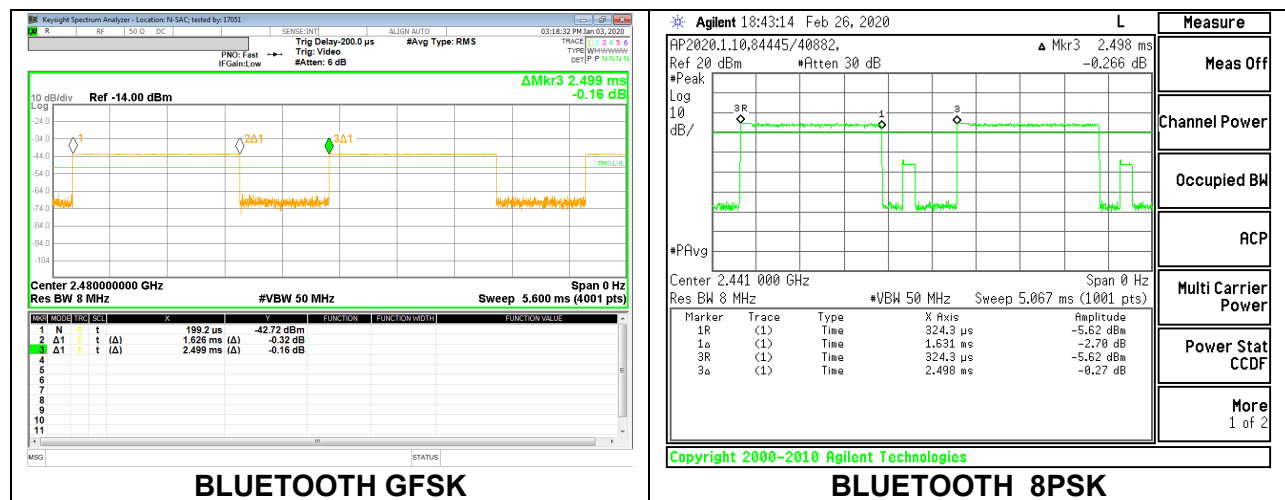
PROCEDURE

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	1.626	2.499	0.651	65.1%	1.87	0.615
Bluetooth 8PSK	1.631	2.498	0.653	65.3%	1.85	0.613

DUTY CYCLE PLOTS



8.2. 20 dB AND 99% BANDWIDTH

LIMITS

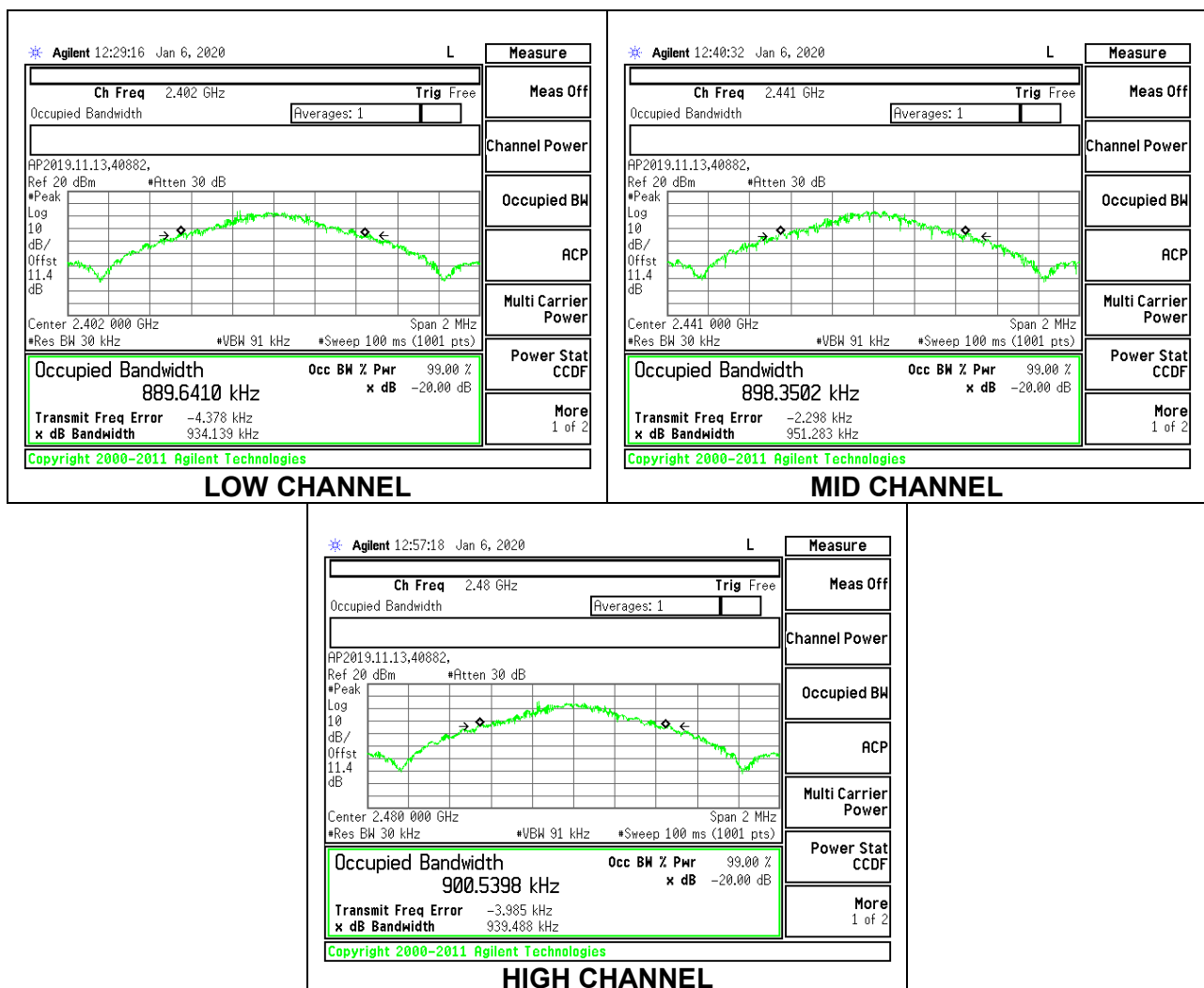
None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to $\geq 1\%$ of the 20 dB bandwidth. The VBW is set to $\geq$ RBW. The sweep time is coupled.

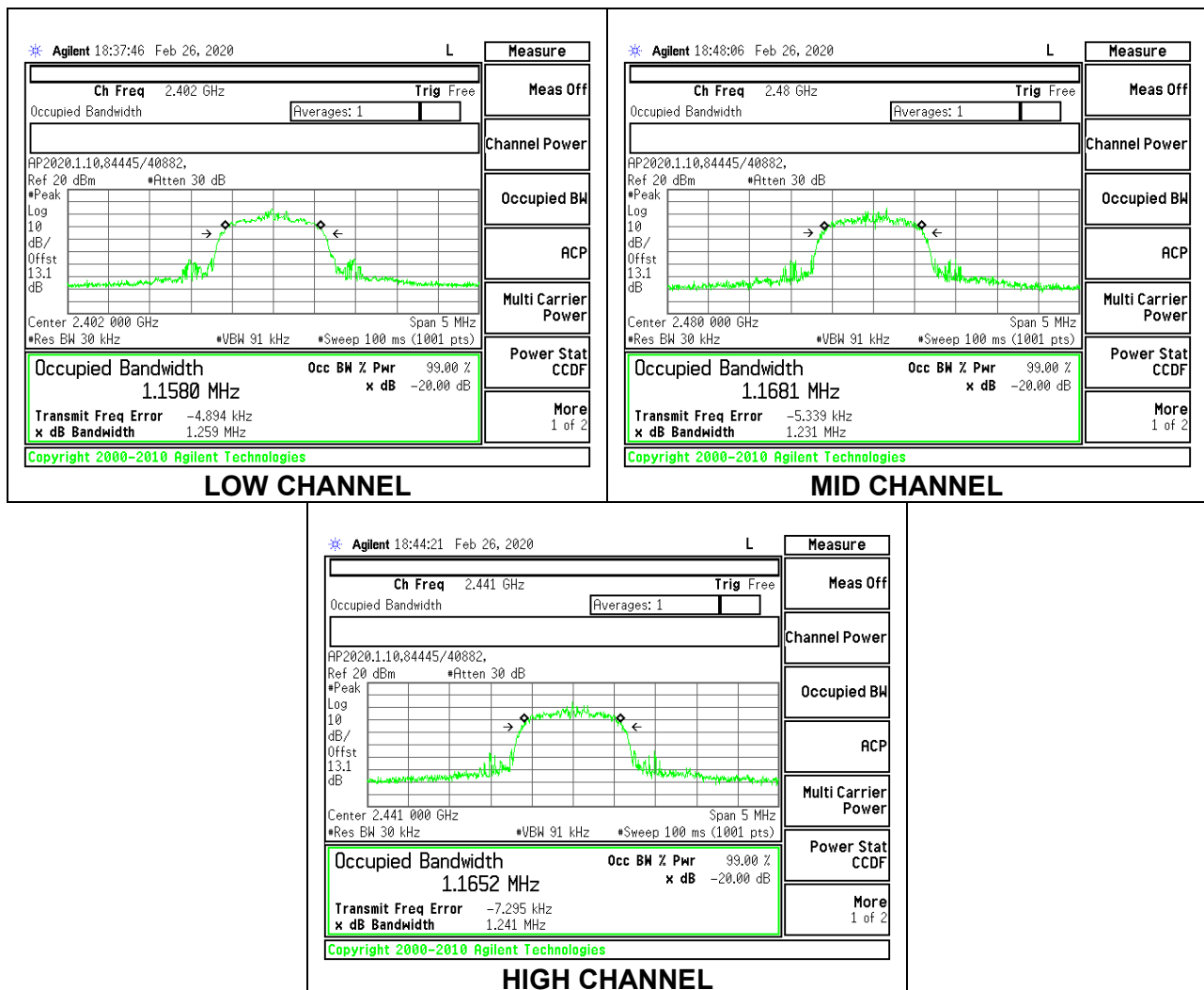
8.2.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	0.934	0.8896
Mid	2441	0.951	0.8983
High	2480	0.939	0.9005



8.2.1. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	1.259	1.158
Mid	2441	1.231	1.1681
High	2480	1.1652	1.241



8.3. HOPPING FREQUENCY SEPARATION

LIMITS

FCC §15.247 (a) (1)

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.

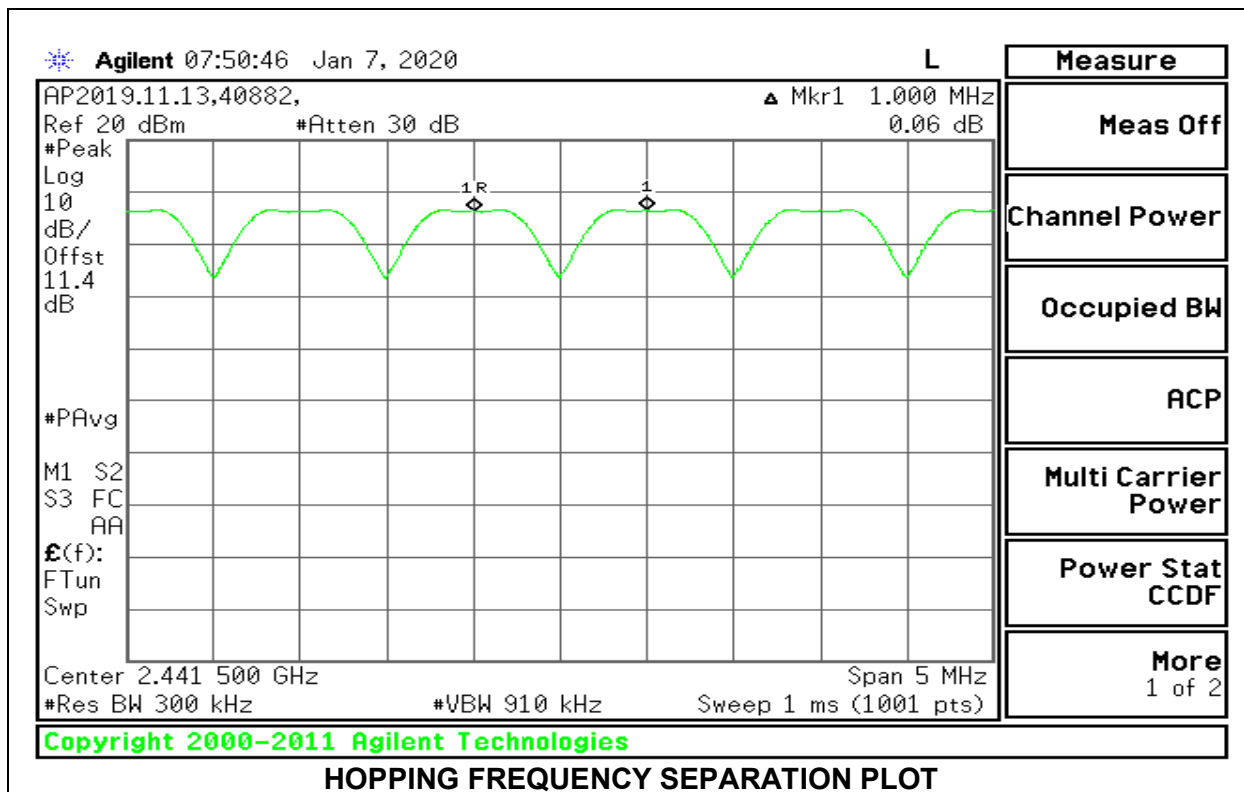
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

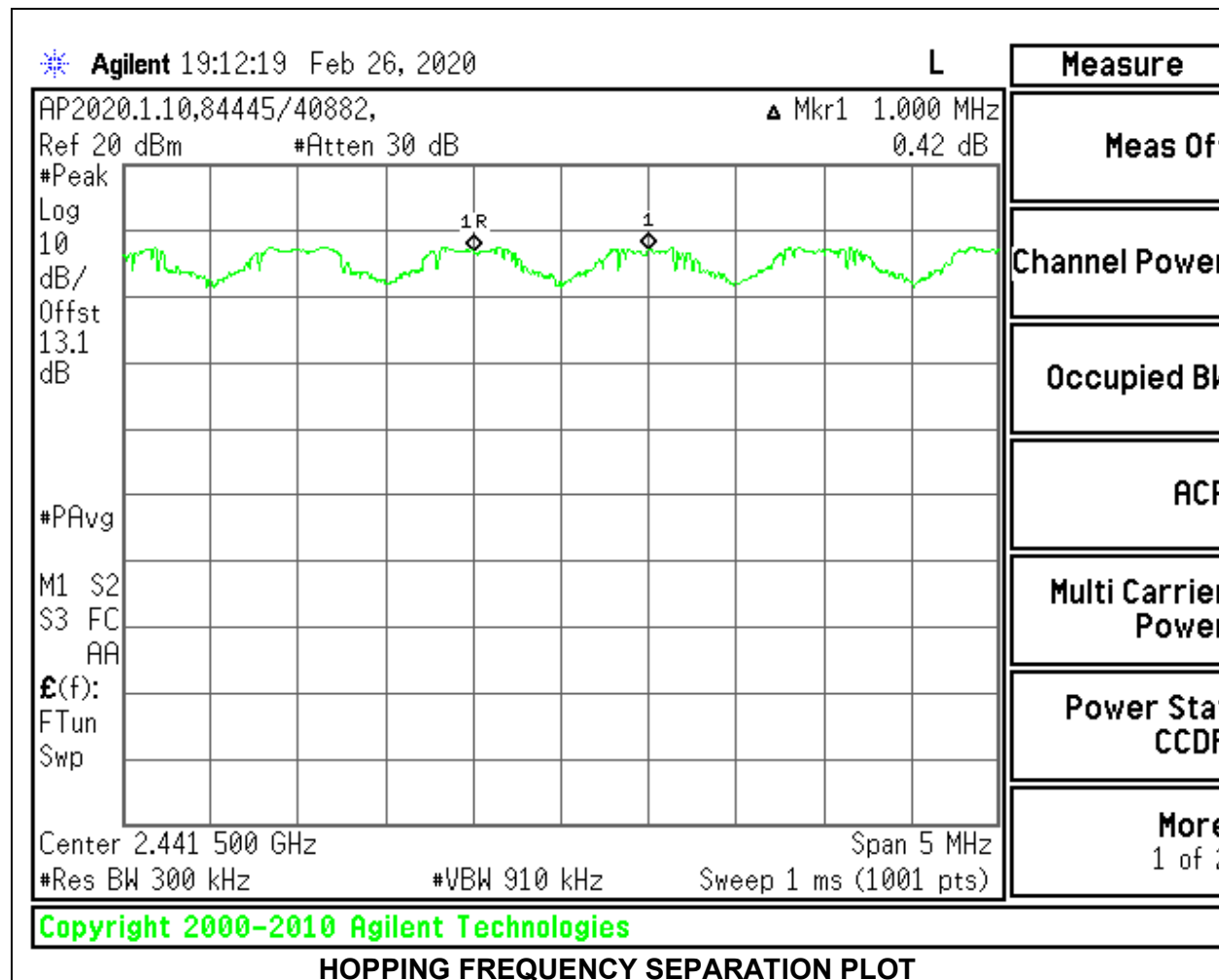
The transmitter output is connected to a spectrum analyzer. The RBW is set to 30% of the channel spacing (approx. 300kHz) and the VBW is set to $VBW \geq RBW$. The sweep time is coupled.

RESULTS

8.3.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION



8.3.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION



Ch. A	Ch. B	Ch. 1 to Ch. 2 Sep.	Max. 20 dB BW	2/3 Max. 20dB BW	Margin
(MHz)	(MHz)	(MHz)	(MHz)	(MHz)	(MHz)
2441	2442	1.000	1.259	0.839	-0.161

Note: Frequency separation is greater than 2/3 of the maximum 20dB BW. Which is allowed as the maximum output power is 7.48 dBm, which is less than 21dBm (125mW).

8.4. NUMBER OF HOPPING CHANNELS

LIMITS

FCC §15.247 (a) (1) (iii)

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

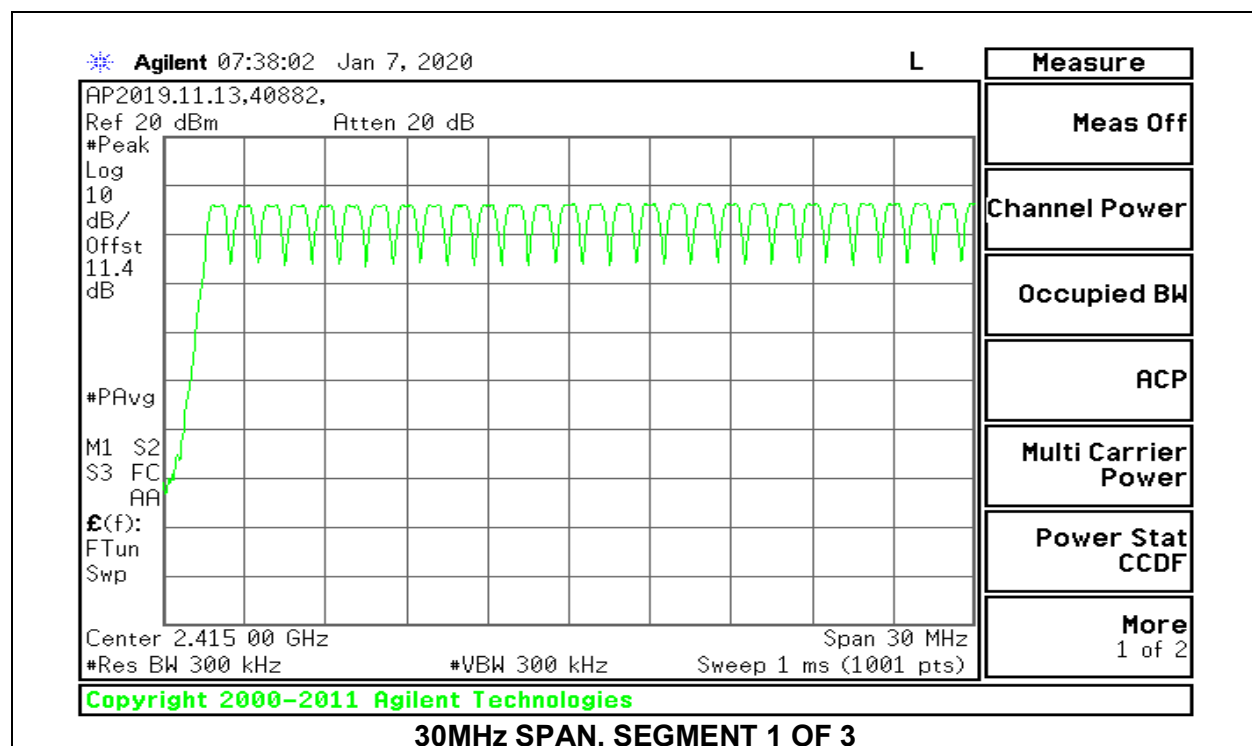
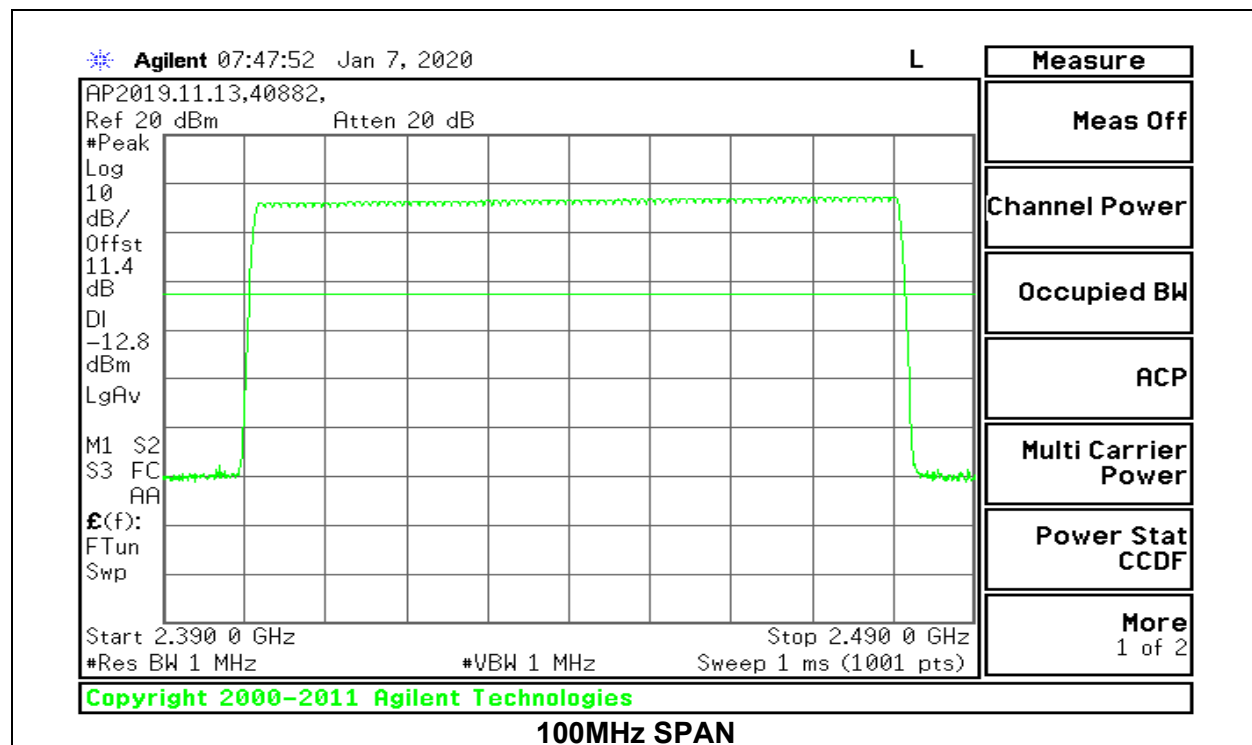
TEST PROCEDURE

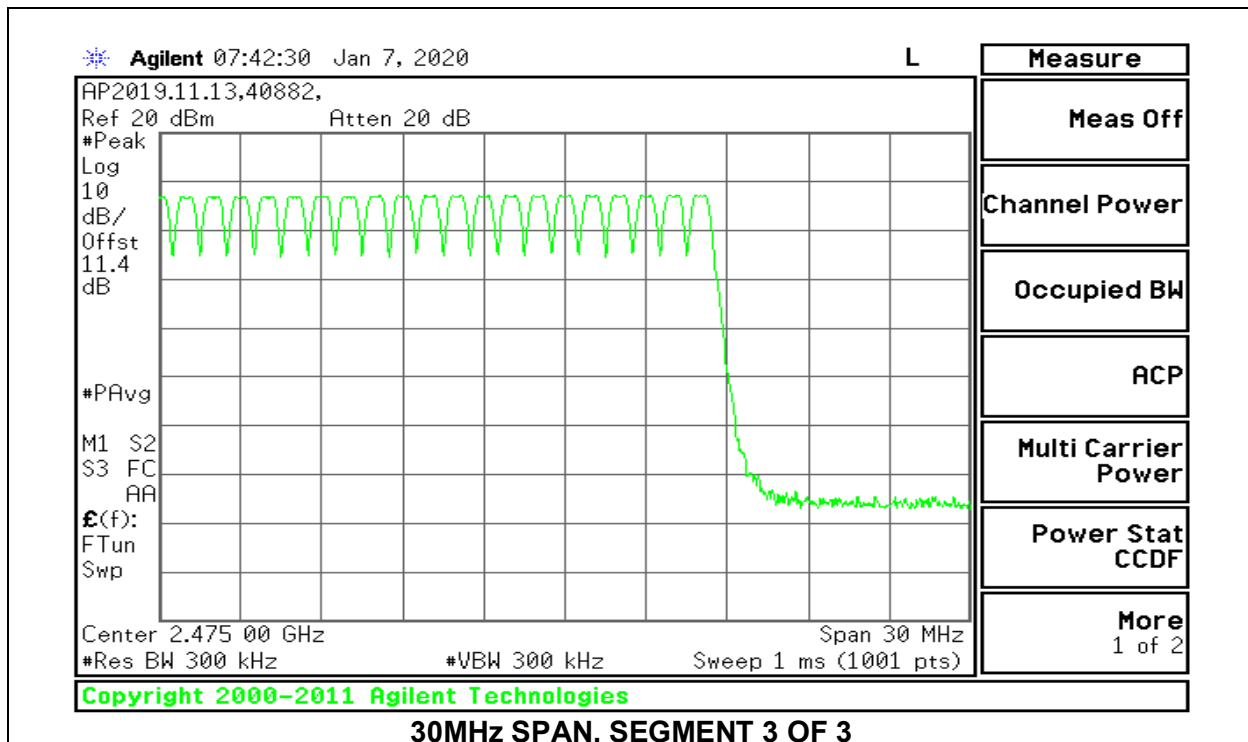
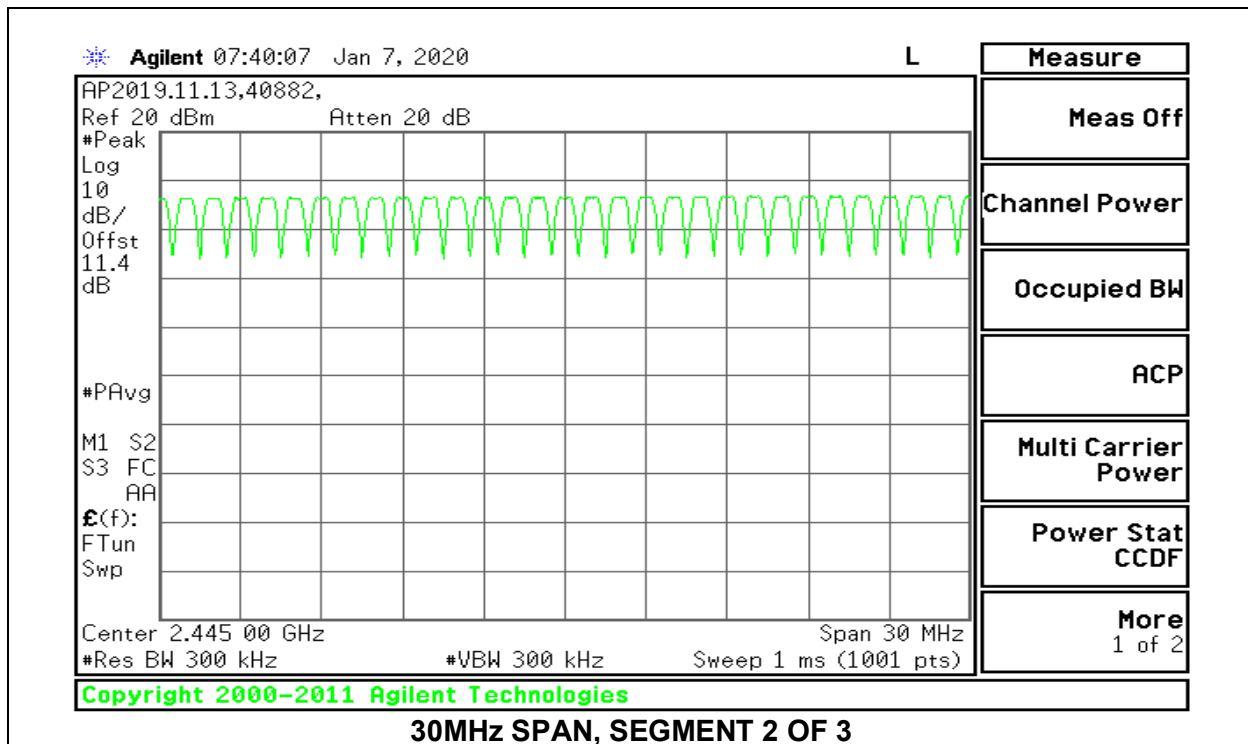
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps for visibility of the entire span. Then, smaller spans are set to more clearly identify the channels. The RBW is set to 30% of the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

RESULTS

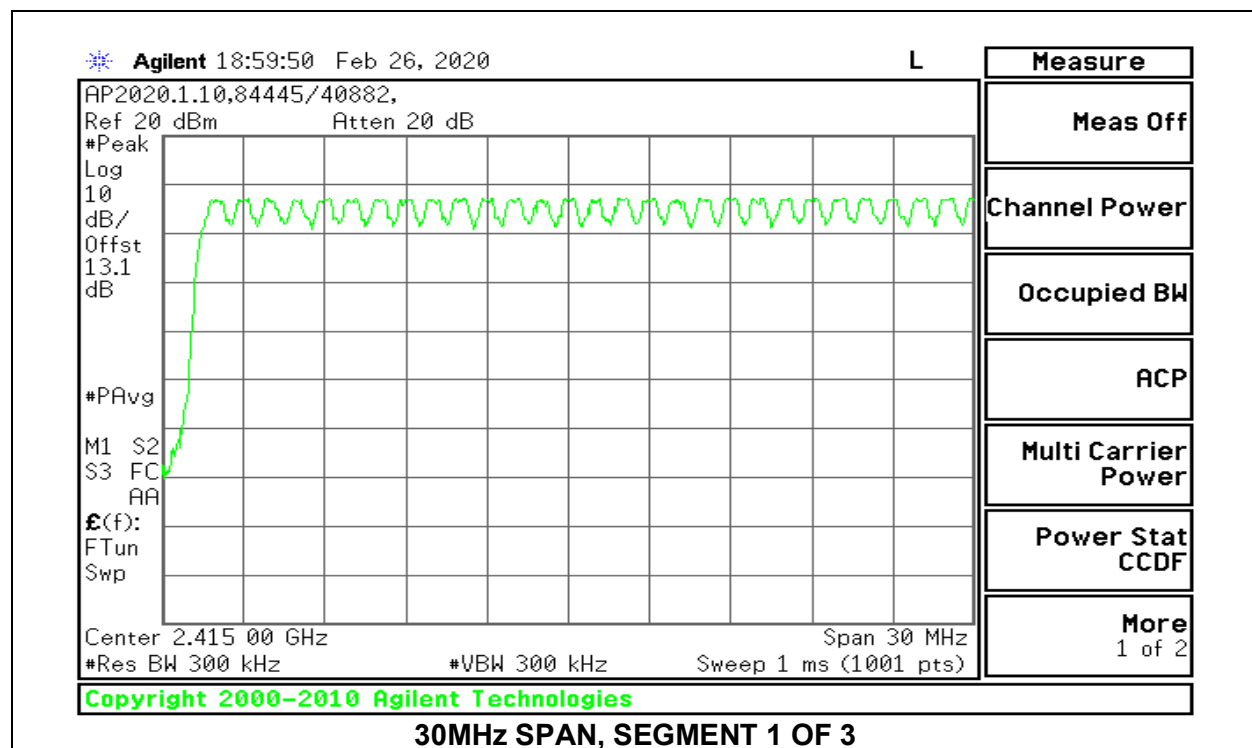
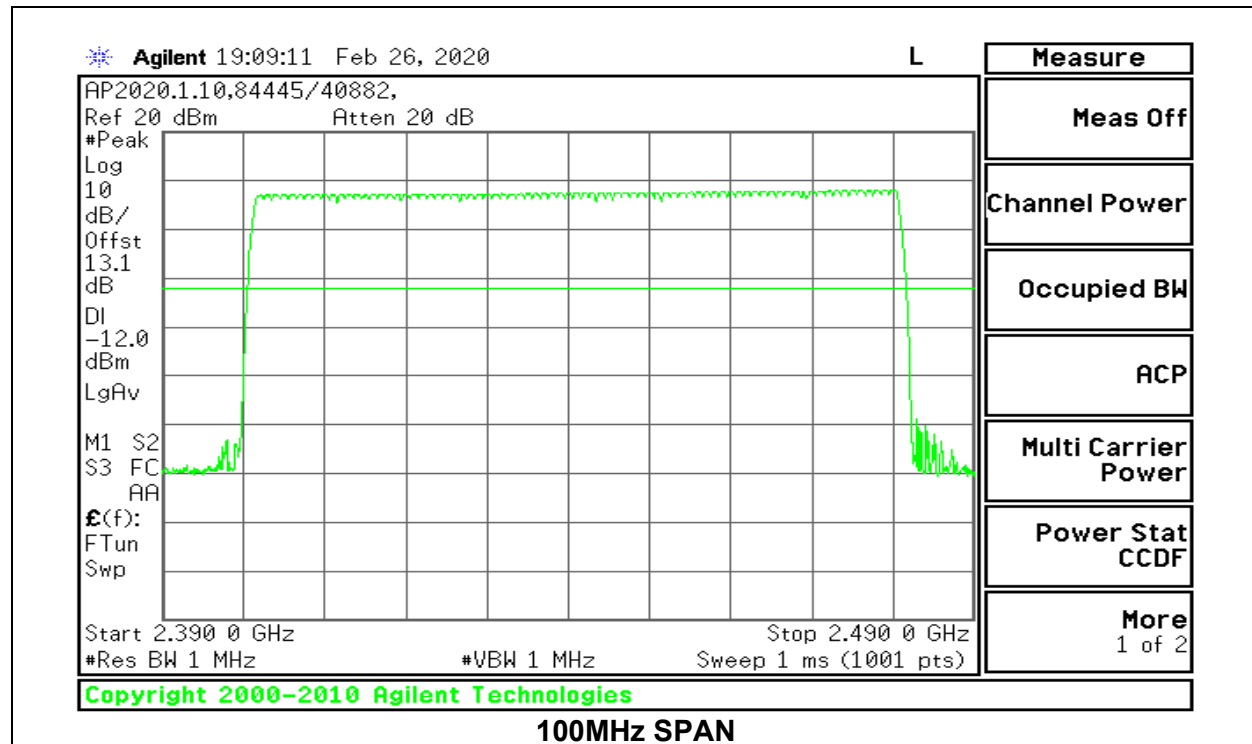
Normal Mode: 79 Channels Observed

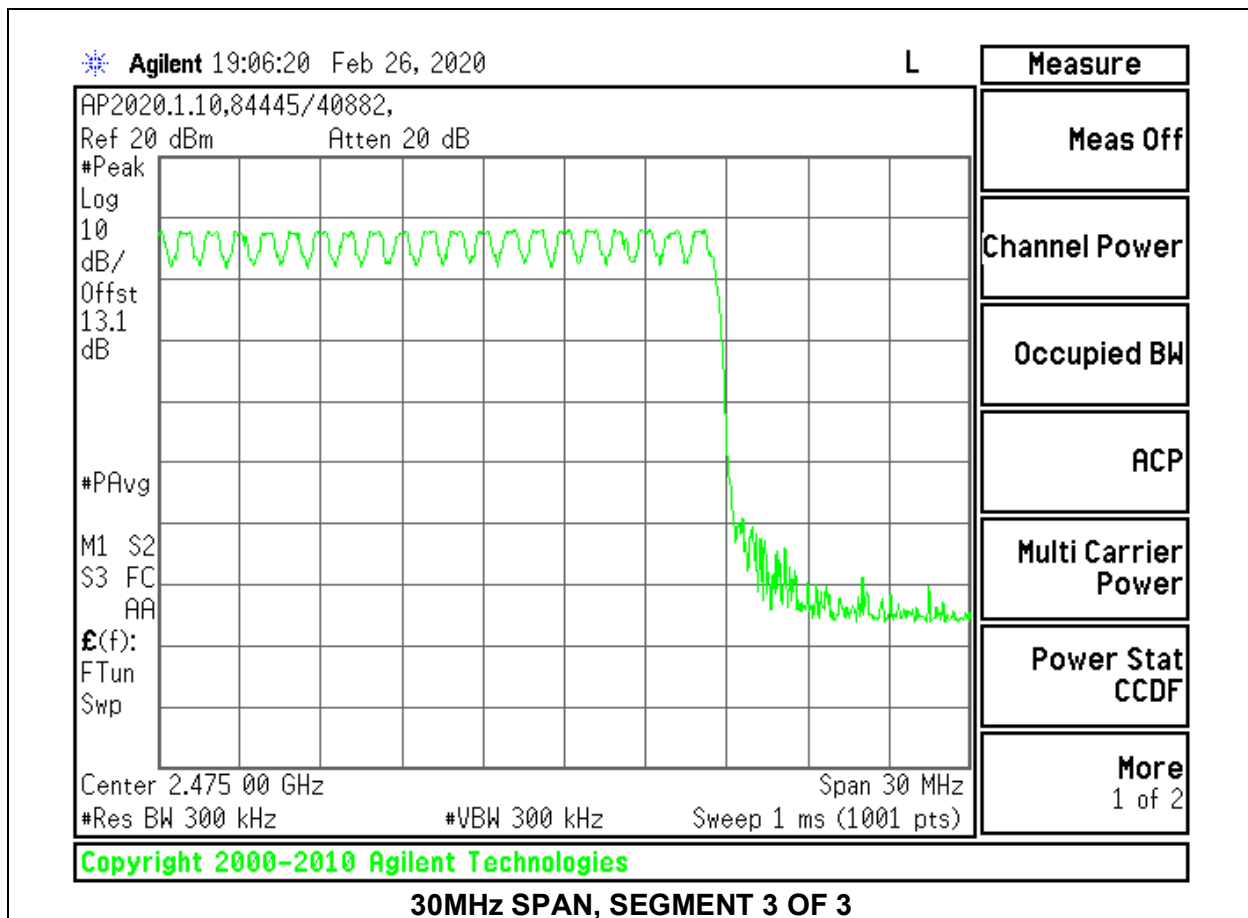
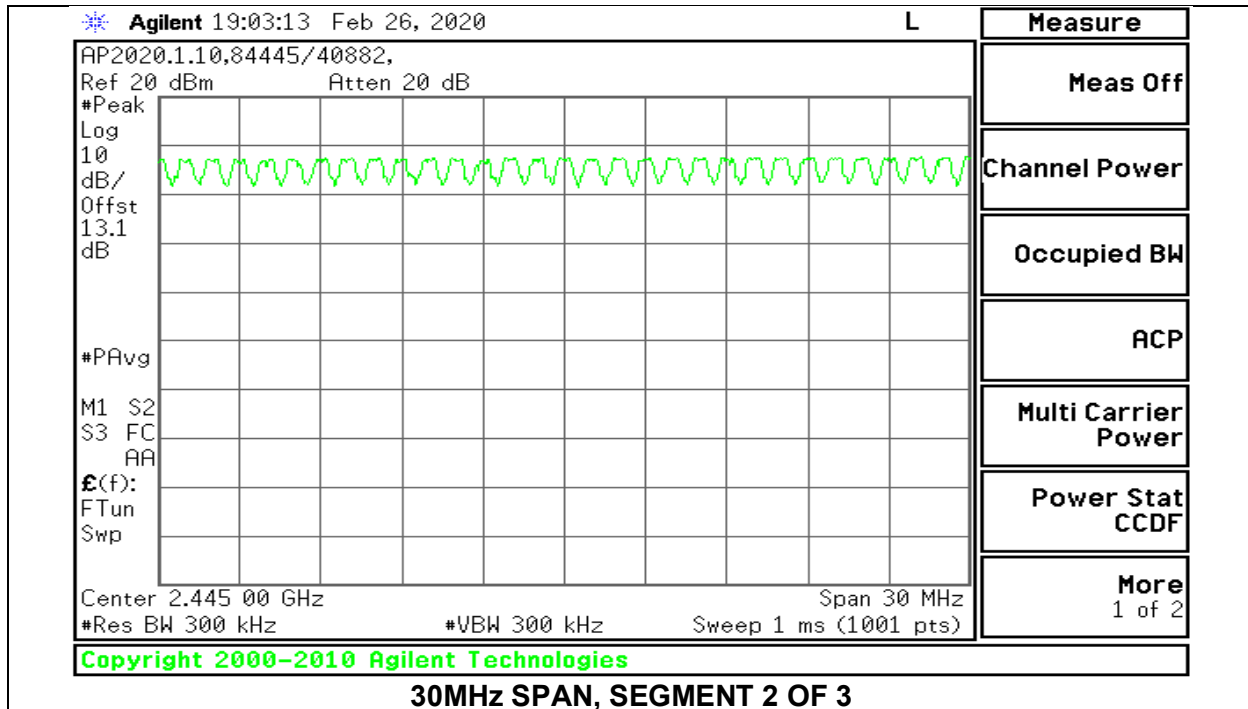
8.4.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION





8.4.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION





8.5. AVERAGE TIME OF OCCUPANCY

LIMITS

FCC §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.

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.

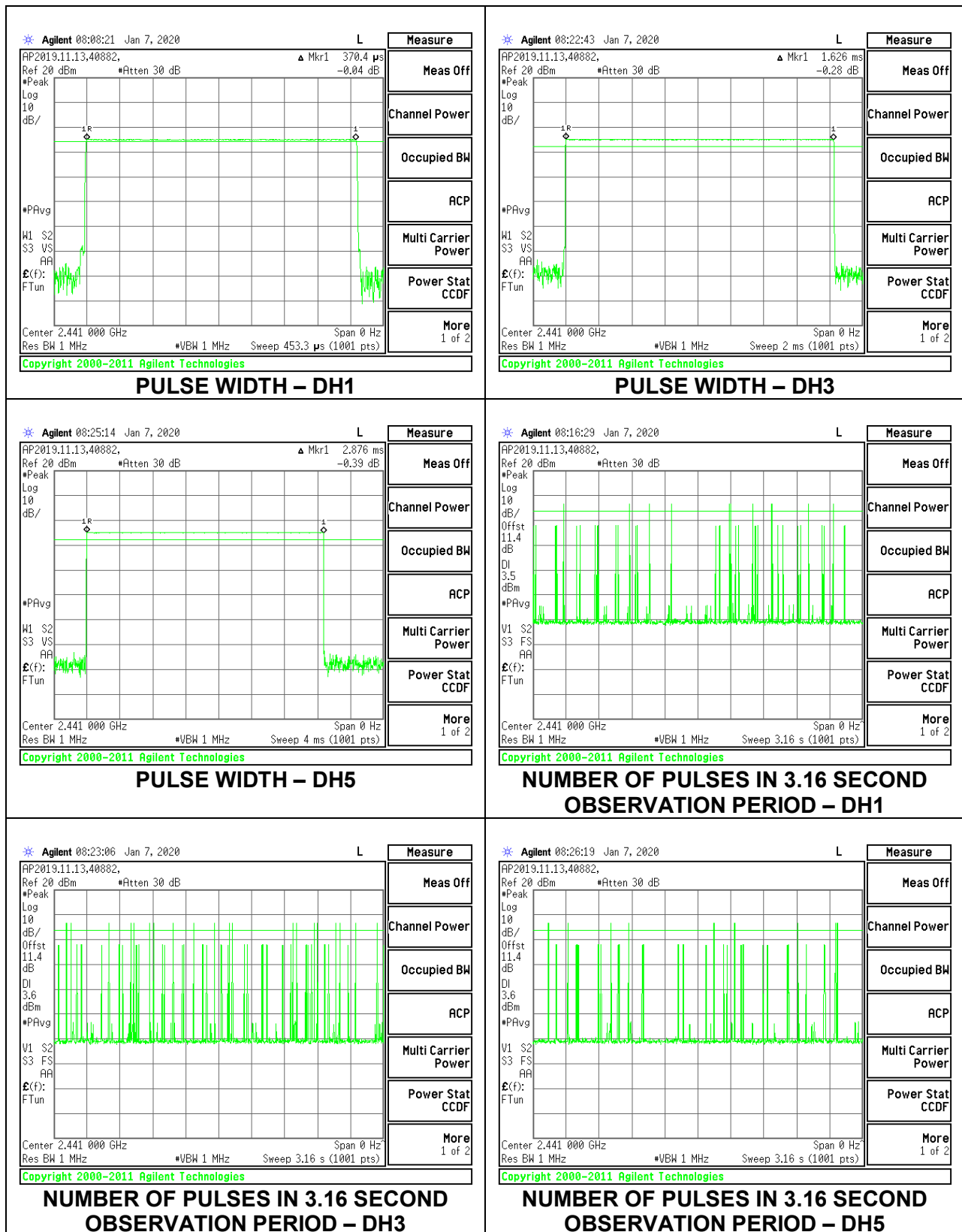
The average time of occupancy in the specified 3.16 second period (79 channels * 0.4 s) is equal to $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{pulse width}$.

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

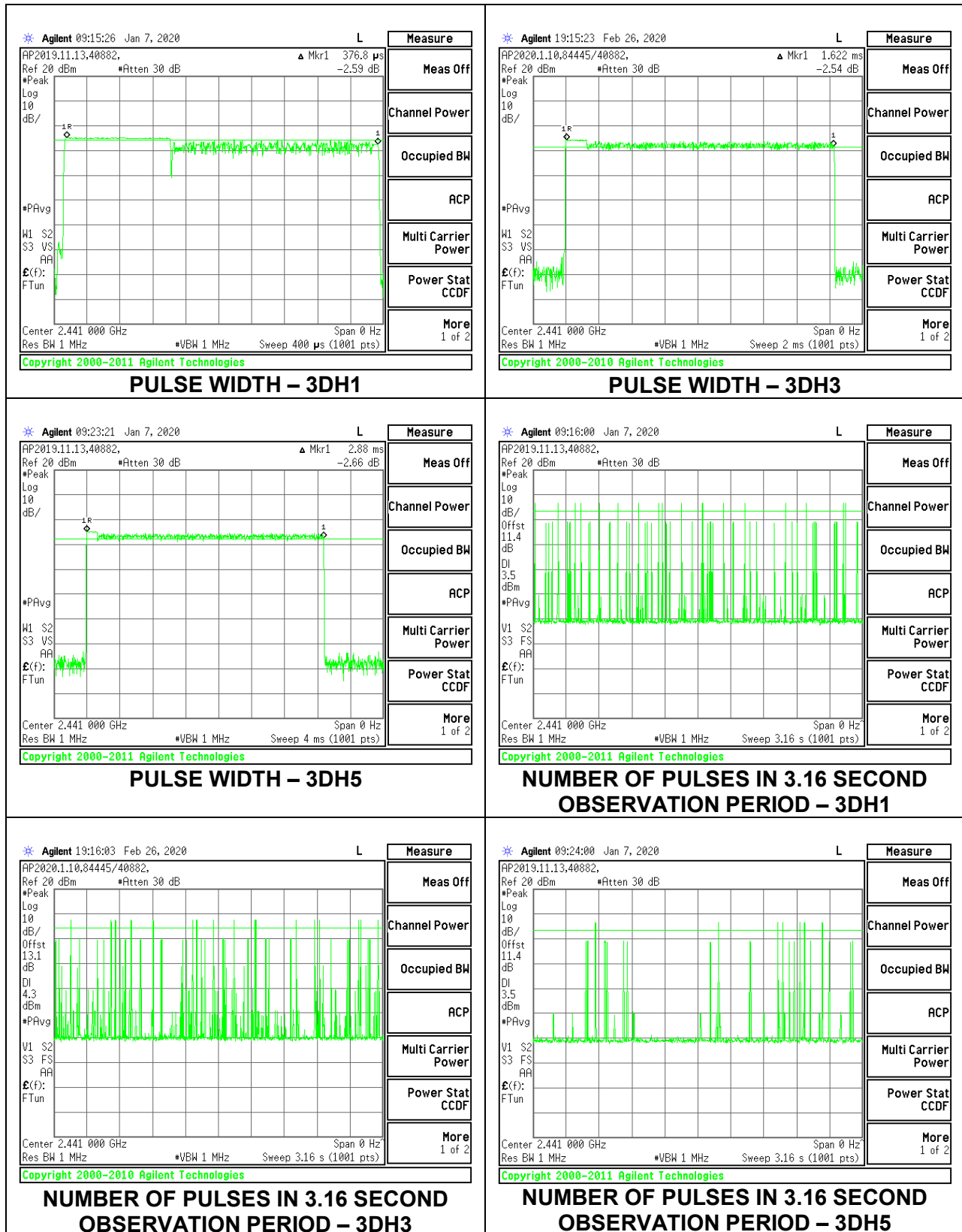
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK Normal Mode					
DH1	0.37	9	0.0333	0.4	-0.3667
DH3	1.626	20	0.3252	0.4	-0.0748
DH5	2.876	8	0.2301	0.4	-0.1699
DH Packet	Pulse Width (sec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK AFH Mode					
DH1	0.37	2.25	0.00833	0.4	-0.3917
DH3	1.626	5	0.08130	0.4	-0.3187
DH5	2.876	2	0.05752	0.4	-0.3425



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	0.3768	16	0.060288	0.4	-0.33971
3DH3	1.622	17	0.27574	0.4	-0.12426
3DH5	2.88	7	0.2016	0.4	-0.1984

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.



8.6. OUTPUT POWER

LIMITS

§15.247 (b) (1)

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 11.41 dB (including 10.61 dB pad and 0.8 dB cable) was entered as an offset for 2020-01-03 testing and 13.1 dB (including 10.61dB pad, 1.33dB cable, and 1.16dB coupler) for 2020-02-26 testing in the power meter to allow for a peak reading of power.

RESULTS

8.6.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Tested By:	40882
Date:	2020-01-03

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	5.89	30	-24.11
Middle	2441	6.43	30	-23.57
High	2480	7	30	-23

8.6.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Tested By:	40882
Date:	2020-02-26

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	6.4	21	-14.6
Middle	2441	6.78	21	-14.22
High	2480	7.48	21	-13.52

8.6.3. BLUETOOTH ENHANCED DATA RATE DQPSK MODULATION

Tested By:	40882
Date:	2020-01-03

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	5.85	30	-24.15
Middle	2441	6.41	30	-23.59
High	2480	7	30	-23

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 11.41 dB (including 10.61 dB pad and 0.8 dB cable) was entered as an offset for 2020-01-03 testing and 13.1 dB (including 10.61dB pad, 1.33dB cable, and 1.16dB coupler) for 2020-02-26 testing 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:	40882
Date	2020-01-03

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	5.69
Middle	2441	6.25
High	2480	6.83

8.7.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Tested By:	40882
Date	2020-02-26

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	3.27
Middle	2441	3.78
High	2480	3.64

8.7.3. BLUETOOTH ENHANCED DATA RATE DQPSK MODULATION

Tested By:	40882
Date	2020-01-03

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	3.09
Middle	2441	3.64
High	2480	4.24

8.8. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

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.

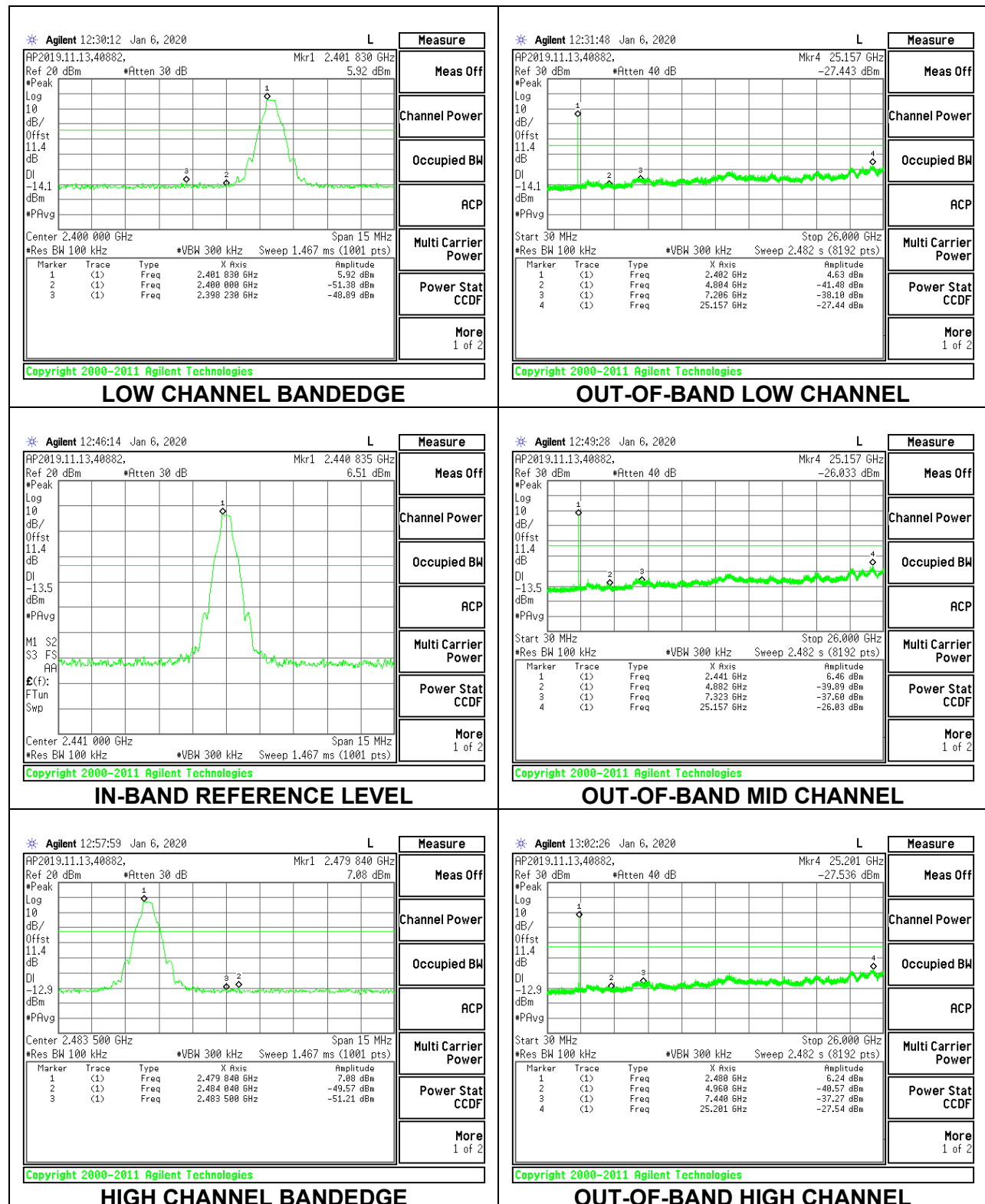
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

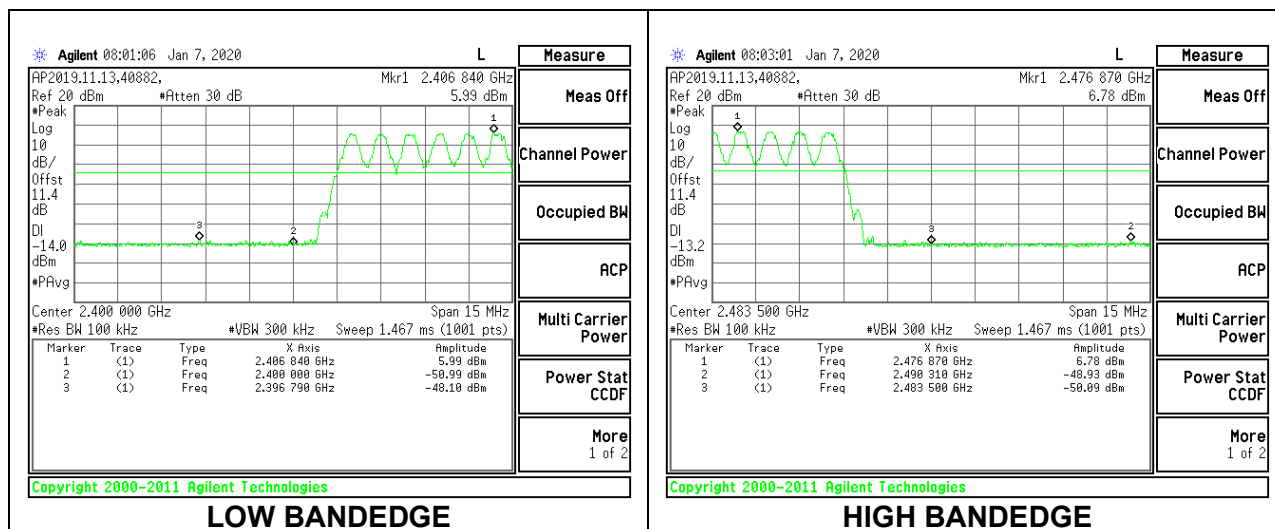
RESULTS

8.8.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Antenna 1 SPURIOUS EMISSIONS, NON-HOPPING

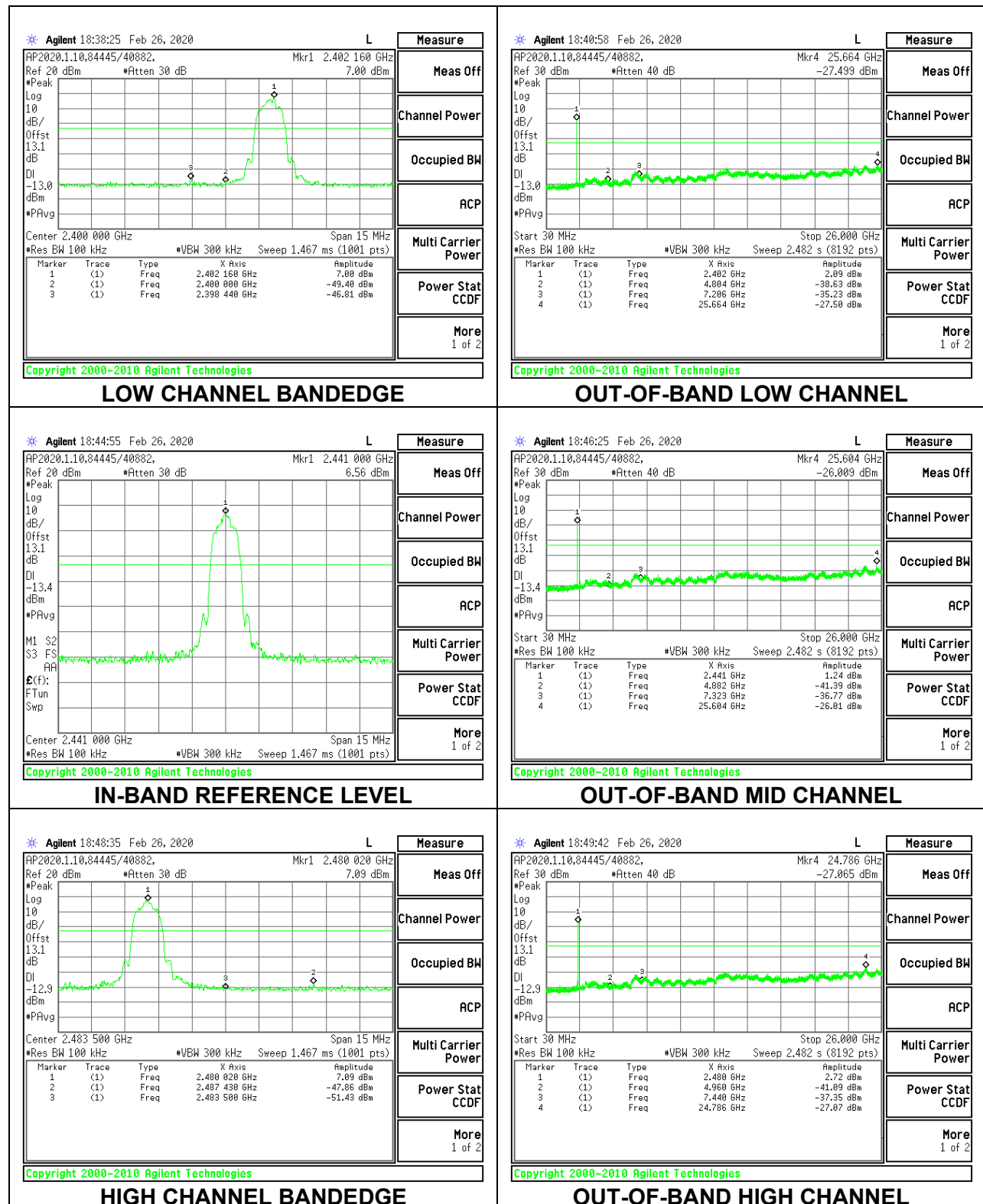


Antenna 1 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

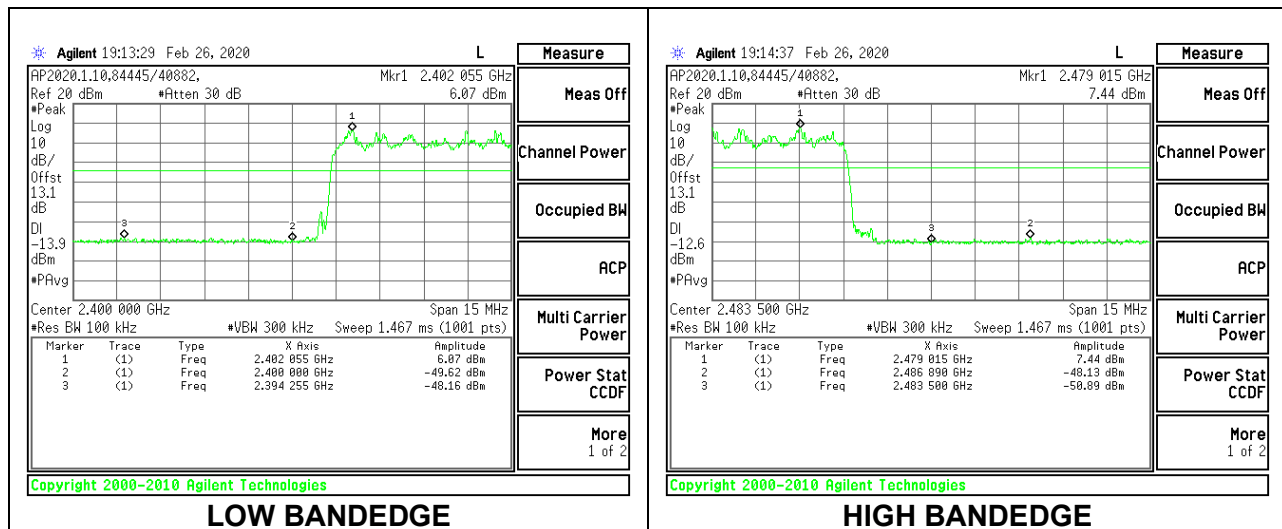


8.8.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

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

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 above 1-18GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements. For average measurements, a 1 MHz resolution bandwidth and a 1/T video bandwidth was used with a peak detector where T = the on time.

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.

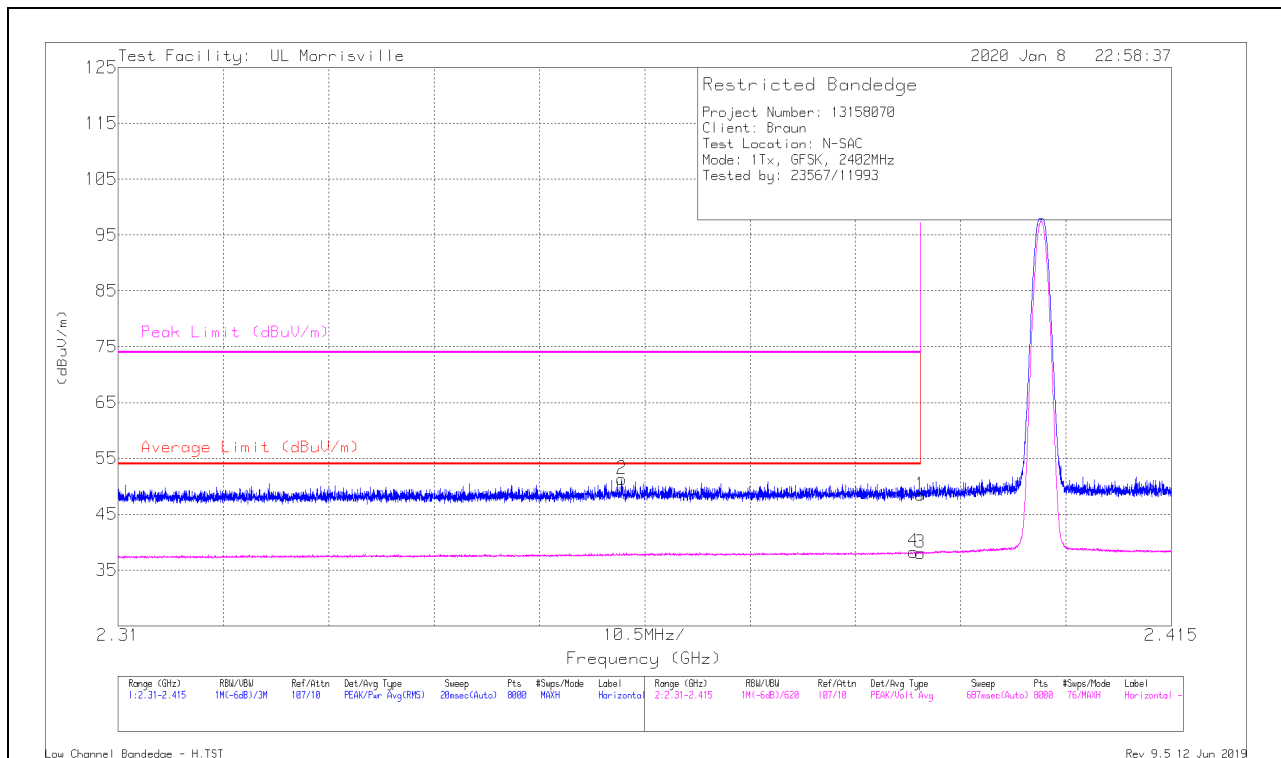
OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

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)	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	40.99	Pk	32	-24.5	48.49	-	-	74	-25.51	103	194	H
2	* ** 2.3602	44.1	Pk	31.8	-24.6	51.3	-	-	74	-22.7	103	194	H
3	* ** 2.39	30.58	V1TV	32	-24.5	38.08	54	-15.92	-	-	103	194	H
4	* ** 2.38929	30.81	V1TV	32	-24.5	38.31	54	-15.69	-	-	103	194	H

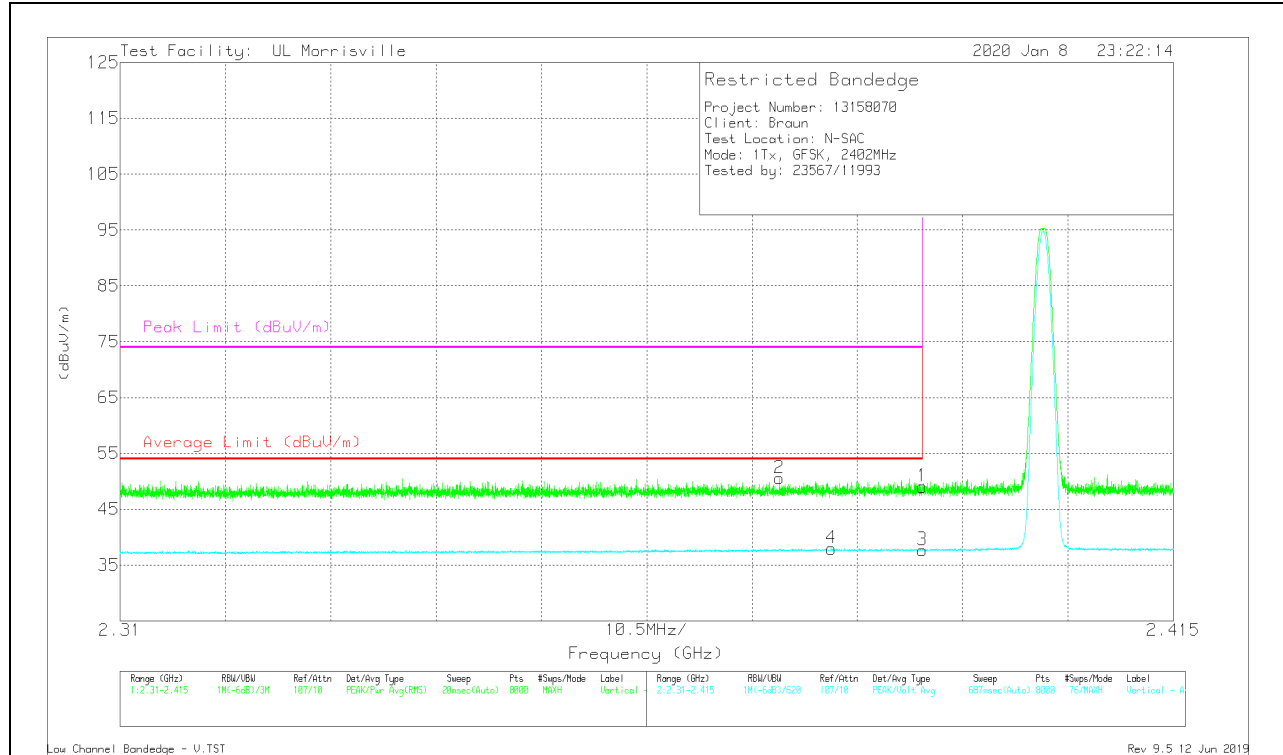
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

V1TV - VB=1/Ton, Linear Voltage Average where: Ton is packet duration

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 AF (dBuV/m)	Amp/Cbl/Filtr/Pad (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	41.56	Pk	32	-24.5	49.06	-	-	74	-24.94	154	341	V
2	*** 2.37573	43.15	Pk	31.9	-24.5	50.55	-	-	74	-23.45	154	341	V
3	*** 2.39	30.17	V1TV	32	-24.5	37.67	54	-16.33	-	-	154	341	V
4	*** 2.38091	30.46	V1TV	32	-24.5	37.96	54	-16.04	-	-	154	341	V

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

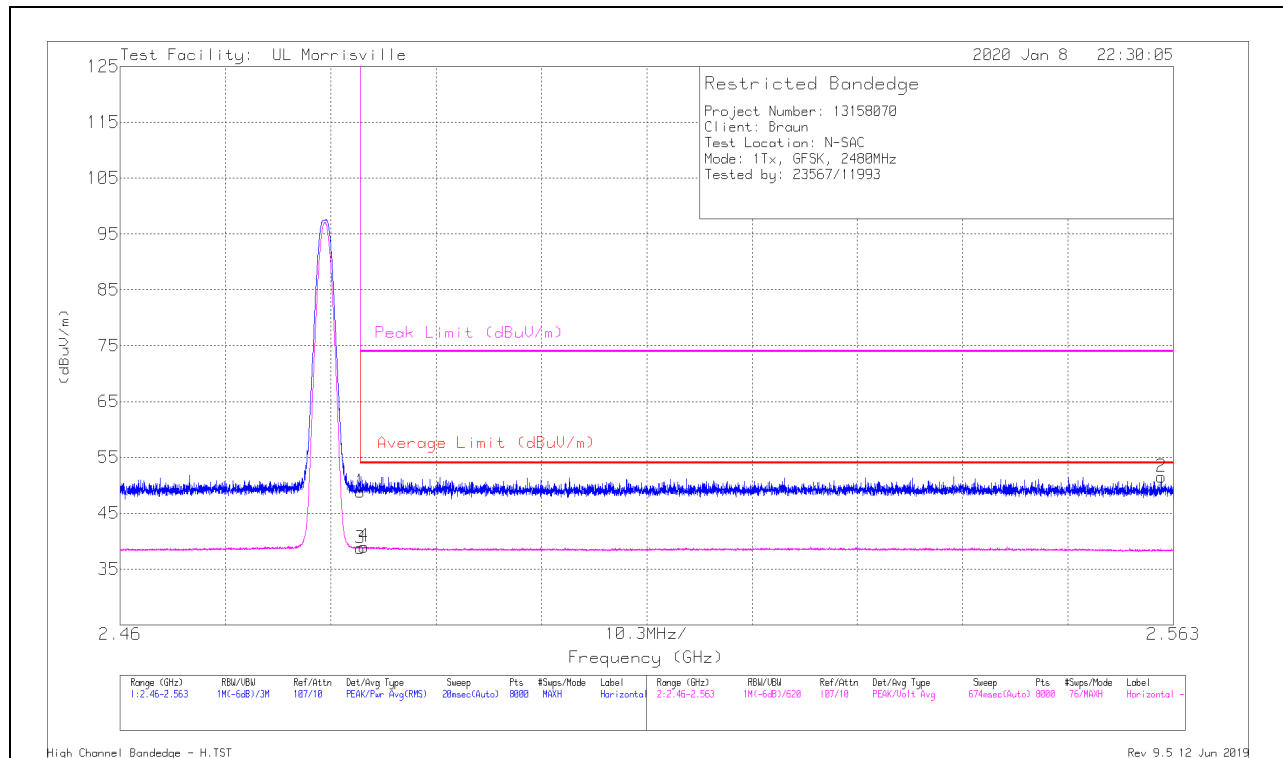
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

V1TV - VB=1/Ton, Linear Voltage Average where: Ton is packet duration

BANEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 AF (dBuV/m)	Amp/Cbl/Filtr/Pad (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	40.75	Pk	32.4	-24.3	48.85	-	-	74	-25.15	99	179	H
2	** 2.56182	43.41	Pk	32.4	-24.3	51.51	-	-	74	-22.49	99	179	H
3	* ** 2.4835	30.65	V1TV	32.4	-24.3	38.75	54	-15.25	-	-	99	179	H
4	* ** 2.48386	30.93	V1TV	32.4	-24.3	39.03	54	-14.97	-	-	99	179	H

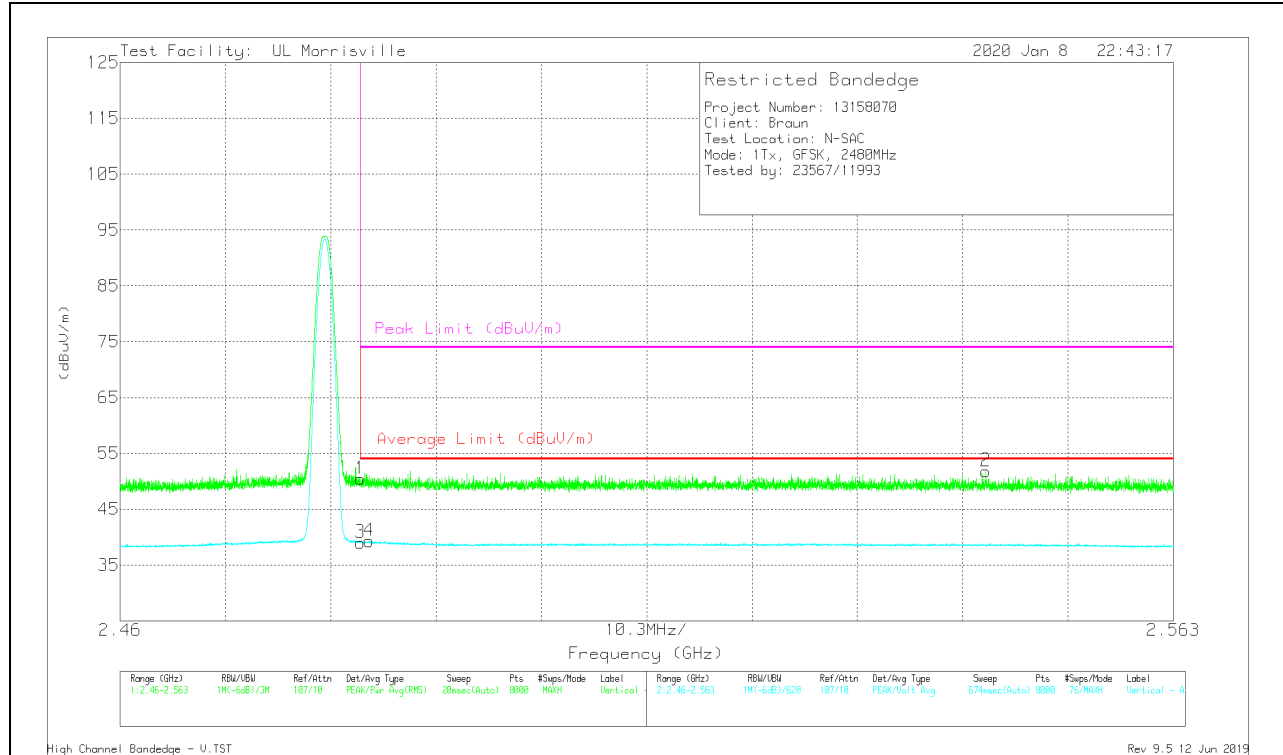
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

V1TV - VB=1/Ton, Linear Voltage Average where: Ton is packet duration

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 AF (dBuV/m)	Amp/Cbl/Filtr/Pad (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	42.34	Pk	32.4	-24.3	50.44	-	-	74	-23.56	177	213	V
2	** 2.54465	43.72	Pk	32.5	-24.4	51.82	-	-	74	-22.18	177	213	V
3	* ** 2.4835	30.92	V1TV	32.4	-24.3	39.02	54	-14.98	-	-	177	213	V
4	* ** 2.48433	31.22	V1TV	32.4	-24.3	39.32	54	-14.68	-	-	177	213	V

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

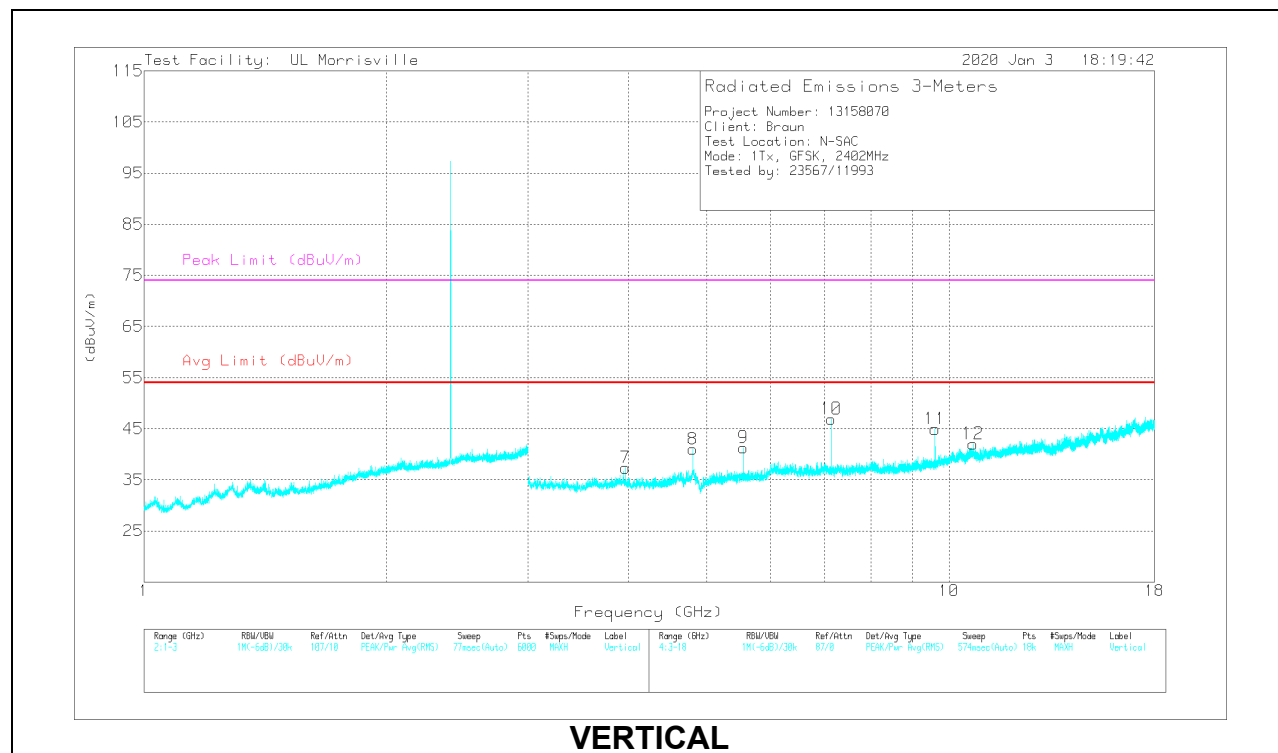
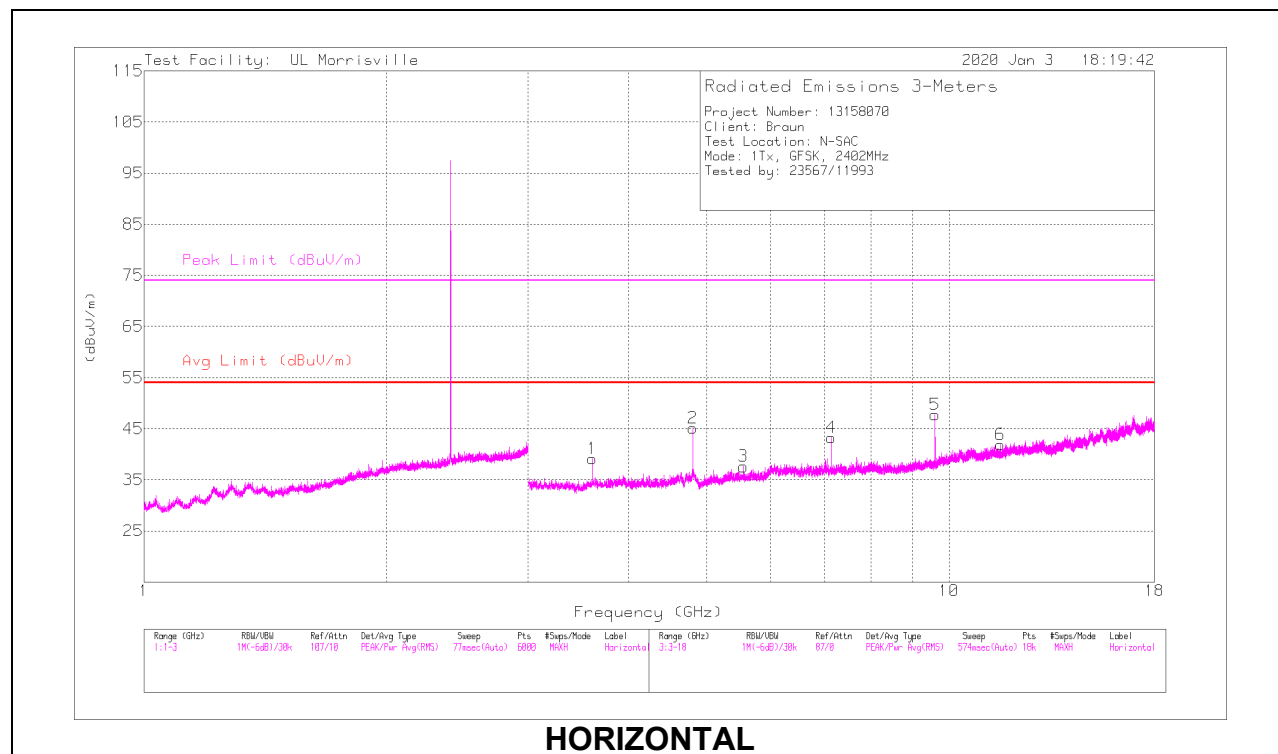
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

V1TV - VB=1/Ton, Linear Voltage Average where: Ton is packet duration

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 AF (dBuV/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 3.6029	43.25	PK-U	33.1	-31.4	44.95	-	-	74	-29.05	334	103	H
	* ** 3.603	34.55	V1TV	33.1	-31.4	36.25	54	-17.75	-	-	334	103	H
2	* ** 4.80381	48.69	PK-U	34.1	-31.6	51.19	-	-	74	-22.81	15	109	H
	* ** 4.80402	42.35	V1TV	34.1	-31.6	44.85	54	-9.15	-	-	15	109	H
6	* ** 11.58222	35.99	PK-U	38.3	-26.1	48.19	-	-	74	-25.81	76	275	H
	* ** 11.58266	22.72	V1TV	38.3	-26.1	34.92	54	-19.08	-	-	76	275	H
7	* ** 3.96509	44.94	PK-U	33.4	-31.7	46.64	-	-	74	-27.36	150	181	V
	* ** 3.96492	34.95	V1TV	33.4	-31.7	36.65	54	-17.35	-	-	150	181	V
8	* ** 4.80396	42.11	PK-U	34.1	-31.6	44.61	-	-	74	-29.39	111	169	V
	* ** 4.8043	29.26	V1TV	34.1	-31.6	31.76	54	-22.24	-	-	111	169	V
12	* ** 10.71218	35.55	PK-U	37.7	-25.1	48.15	-	-	74	-25.85	313	123	V
	* ** 10.71254	22.62	V1TV	37.7	-25.1	35.22	54	-18.78	-	-	313	123	V
3	5.55098	35.4	Pk	34.5	-32.3	37.6	-	-	-	-	0-360	102	H
9	5.55098	39.07	Pk	34.5	-32.3	41.27	-	-	-	-	0-360	102	V
4	7.1369	37.54	Pk	35.7	-30	43.24	-	-	-	-	0-360	102	H
10	7.1369	41.19	Pk	35.7	-30	46.89	-	-	-	-	0-360	102	V
5	9.60787	39.14	Pk	36.6	-28	47.74	-	-	-	-	0-360	198	H
11	9.60787	36.36	Pk	36.6	-28	44.96	-	-	-	-	0-360	198	V

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

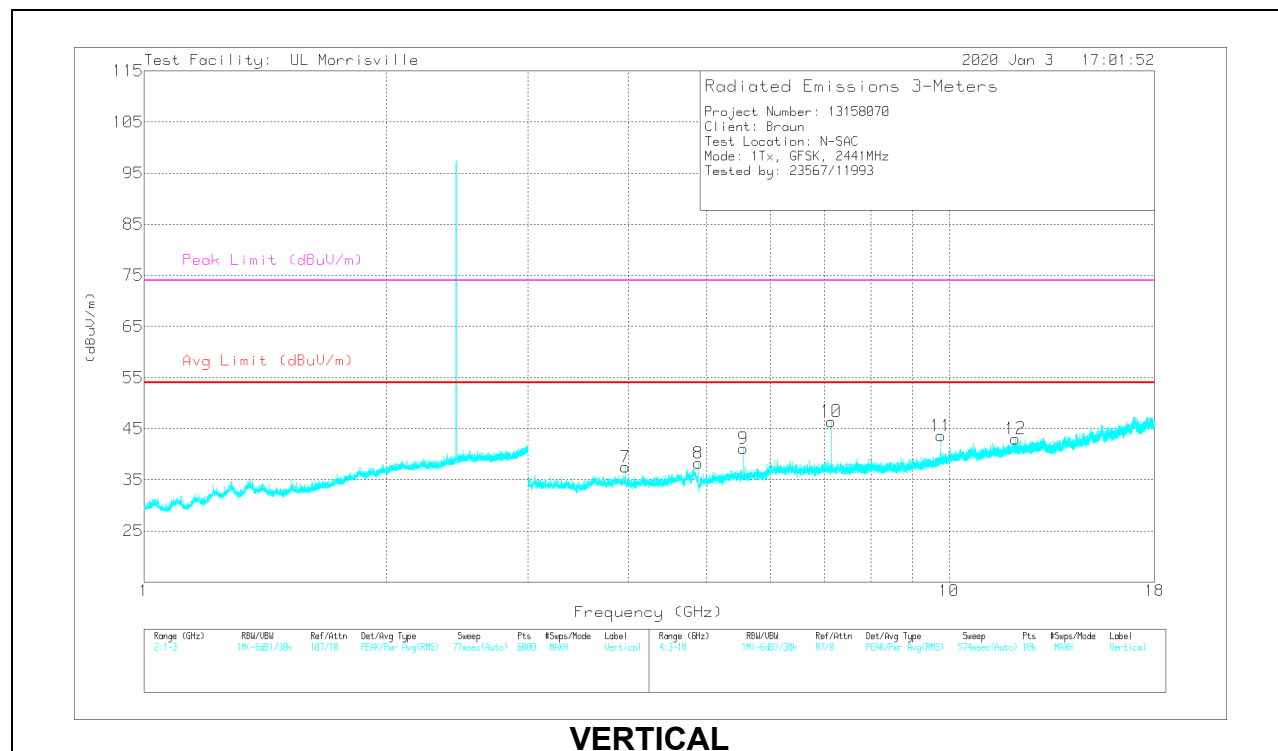
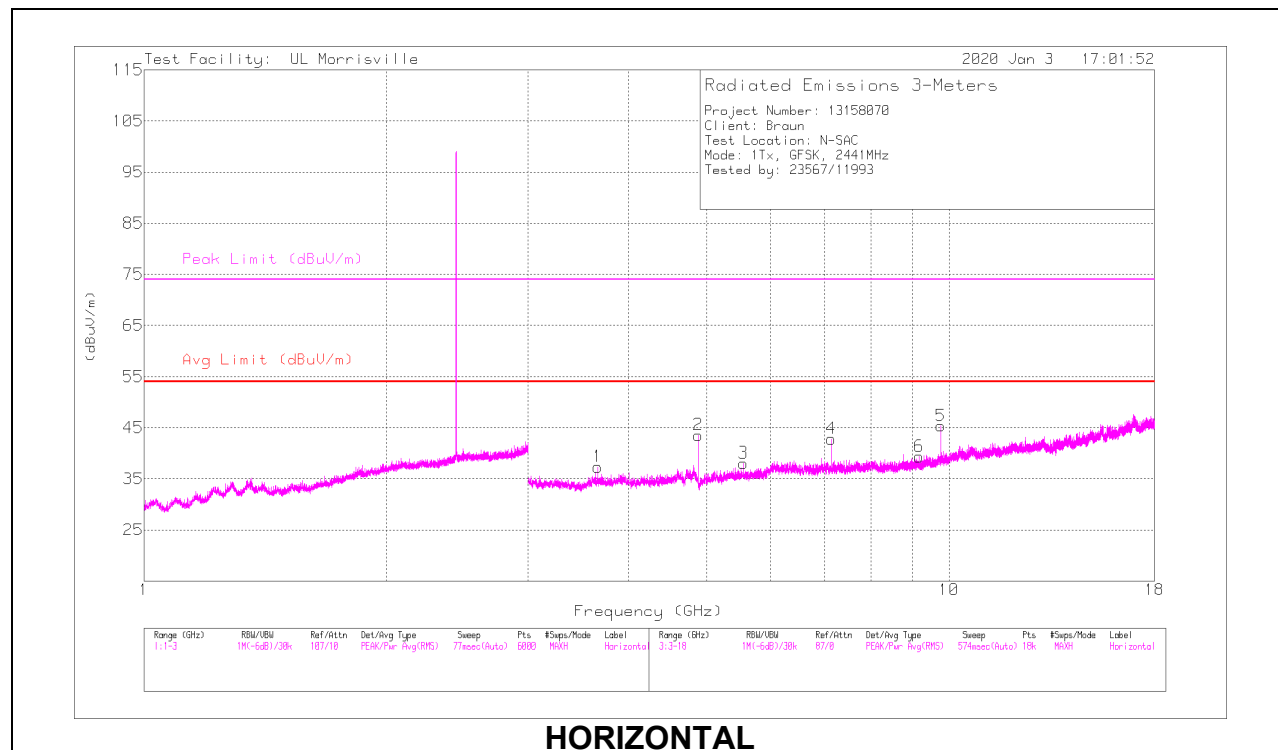
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

PK-U - Maximum Peak

V1TV - VB=1/Ton, Linear Voltage Average where: Ton is packet duration

Pk - Peak detector

MID CHANNEL RESULTS



RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 AF (dBuV/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	*** 3.66161	43.3	PK-U	33.1	-31.5	44.9	-	-	74	-29.1	322	102	H
	*** 3.66152	33.06	V1TV	33.1	-31.5	34.66	54	-19.34	-	-	322	102	H
2	*** 4.88189	46.61	PK-U	33.9	-31.3	49.21	-	-	74	-24.79	7	102	H
	*** 4.88198	40.55	V1TV	33.9	-31.3	43.15	54	-10.85	-	-	7	102	H
6	*** 9.17641	37.24	PK-U	36.1	-27.9	45.44	-	-	74	-28.56	340	388	H
	*** 9.17707	24.33	V1TV	36.1	-27.9	32.53	54	-21.47	-	-	340	388	H
7	*** 3.96505	44.89	PK-U	33.4	-31.7	46.59	-	-	74	-27.41	127	167	V
	*** 3.96504	35.33	V1TV	33.4	-31.7	37.03	54	-16.97	-	-	127	167	V
8	*** 4.88221	43.28	PK-U	33.9	-31.3	45.88	-	-	74	-28.12	160	229	V
	*** 4.88201	35.27	V1TV	33.9	-31.3	37.87	54	-16.13	-	-	160	229	V
12	*** 12.09171	34.96	PK-U	38.7	-25.6	48.06	-	-	74	-25.94	226	358	V
	*** 12.09194	22.49	V1TV	38.7	-25.6	35.59	54	-18.41	-	-	226	358	V
3	5.55098	35.87	Pk	34.5	-32.3	38.07	-	-	-	-	0-360	102	H
9	5.55098	38.91	Pk	34.5	-32.3	41.11	-	-	-	-	0-360	102	V
4	7.1369	37.13	Pk	35.7	-30	42.83	-	-	-	-	0-360	102	H
10	7.1369	40.7	Pk	35.7	-30	46.4	-	-	-	-	0-360	102	V
5	9.76371	35.75	Pk	36.8	-27.2	45.35	-	-	-	-	0-360	102	H
11	9.76371	34.03	Pk	36.8	-27.2	43.63	-	-	-	-	0-360	102	V

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

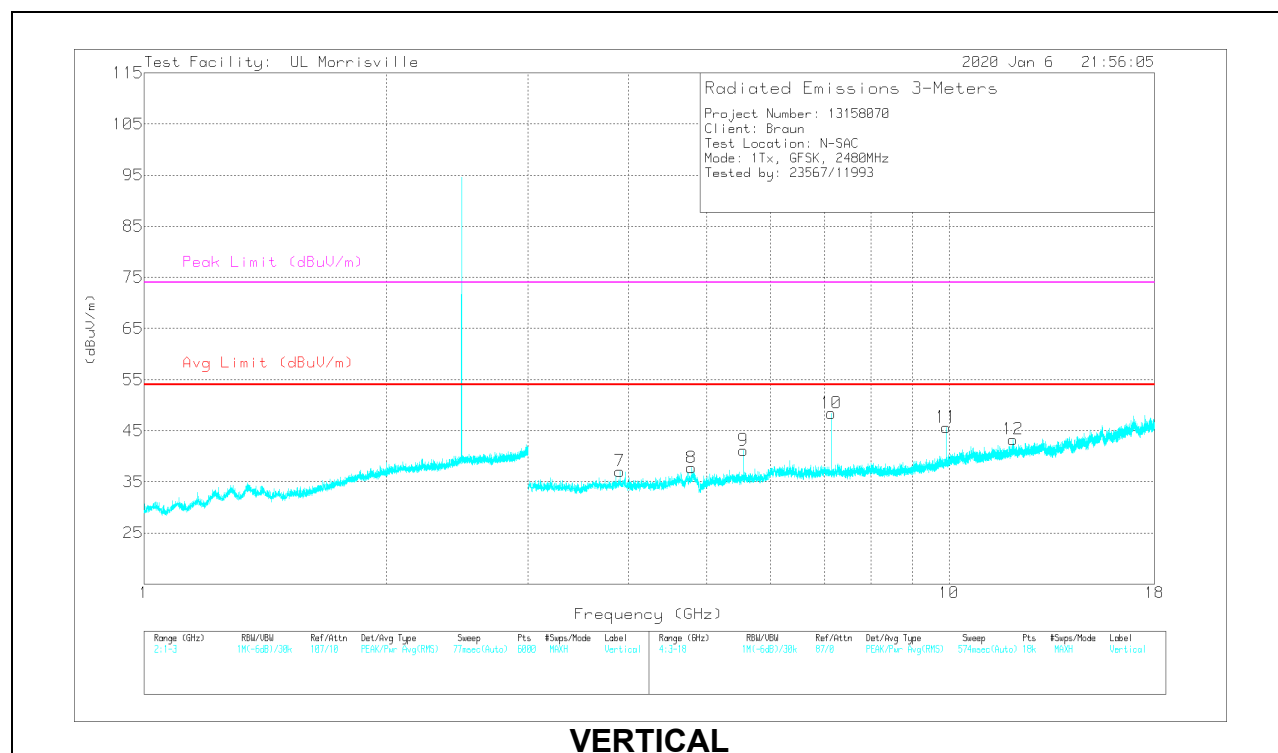
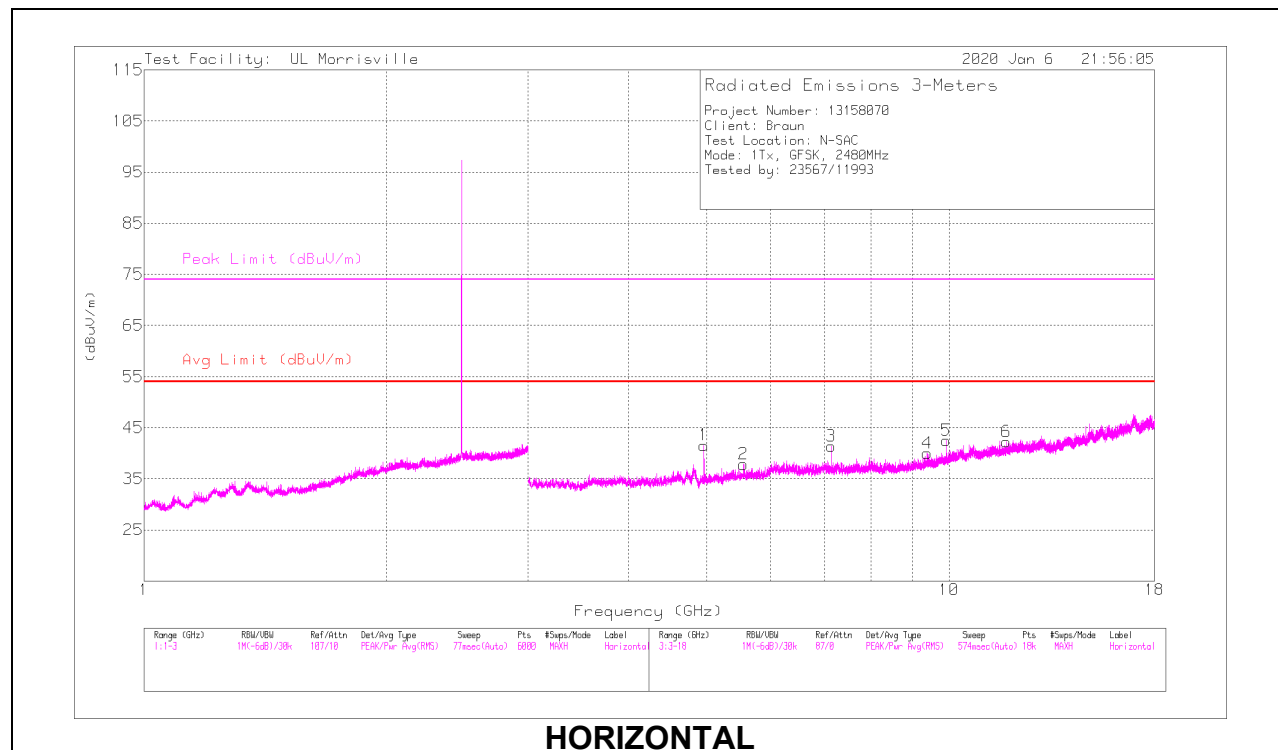
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

PK-U - Maximum Peak

V1TV - VB=1/Ton, Linear Voltage Average where: Ton is packet duration

Pk - Peak detector

HIGH CHANNEL RESULTS



RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 AF (dBuV/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 4.95902	39.69	PK-U	33.9	-32.3	41.29	-	-	74	-32.71	19	110	H
	* ** 4.95916	27.51	V1TV	33.9	-32.3	29.11	54	-24.89	-	-	19	110	H
4	* ** 9.39509	37.1	PK-U	36.4	-28	45.5	-	-	74	-28.5	255	375	H
	* ** 9.39473	24.8	V1TV	36.4	-28	33.2	54	-20.8	-	-	255	375	H
6	* ** 11.77872	35.32	PK-U	38.5	-25.9	47.92	-	-	74	-26.08	127	285	H
	* ** 11.77841	22.94	V1TV	38.5	-25.9	35.54	54	-18.46	-	-	127	285	H
7	* ** 3.90079	40.39	PK-U	33.5	-31.8	42.09	-	-	74	-31.91	39	122	V
	* ** 3.90159	28.12	V1TV	33.5	-31.8	29.82	54	-24.18	-	-	39	122	V
8	* ** 4.78504	40.58	PK-U	34	-31.6	42.98	-	-	74	-31.02	131	187	V
	* ** 4.78435	28.03	V1TV	34	-31.6	30.43	54	-23.57	-	-	131	187	V
12	* ** 12.01059	35.65	PK-U	38.7	-25.6	48.75	-	-	74	-25.25	358	154	V
	* ** 12.01095	22.8	V1TV	38.7	-25.6	35.9	54	-18.1	-	-	358	154	V
2	5.55098	35.65	Pk	34.5	-32.3	37.85	-	-	-	-	0-360	102	H
9	5.55098	38.96	Pk	34.5	-32.3	41.16	-	-	-	-	0-360	102	V
3	7.1369	35.68	Pk	35.7	-30	41.38	-	-	-	-	0-360	102	H
10	7.1369	42.73	Pk	35.7	-30	48.43	-	-	-	-	0-360	102	V
5	9.91955	33.2	Pk	37	-27.7	42.5	-	-	-	-	0-360	102	H
11	9.91955	36.36	Pk	37	-27.7	45.66	-	-	-	-	0-360	102	V

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

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

PK-U - Maximum Peak

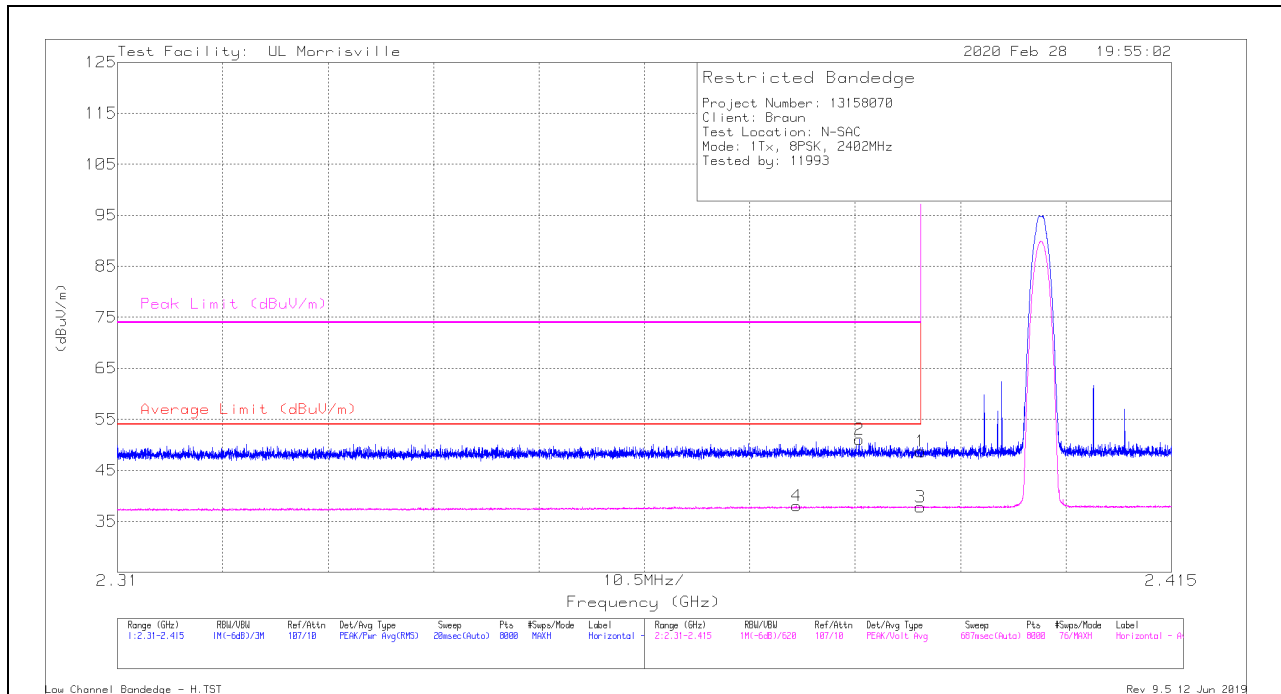
V1TV - VB=1/Ton, Linear Voltage Average where: Ton is packet duration

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)	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	41.2	Pk	32	-24.5	48.7	-	-	74	-25.3	42	300	H
2	* ** 2.38391	43.57	Pk	32	-24.5	51.07	-	-	74	-22.93	42	300	H
3	* ** 2.39	30.33	V1TV	32	-24.5	37.83	54	-16.17	-	-	42	300	H
4	* ** 2.37764	30.53	V1TV	32	-24.5	38.03	54	-15.97	-	-	42	300	H

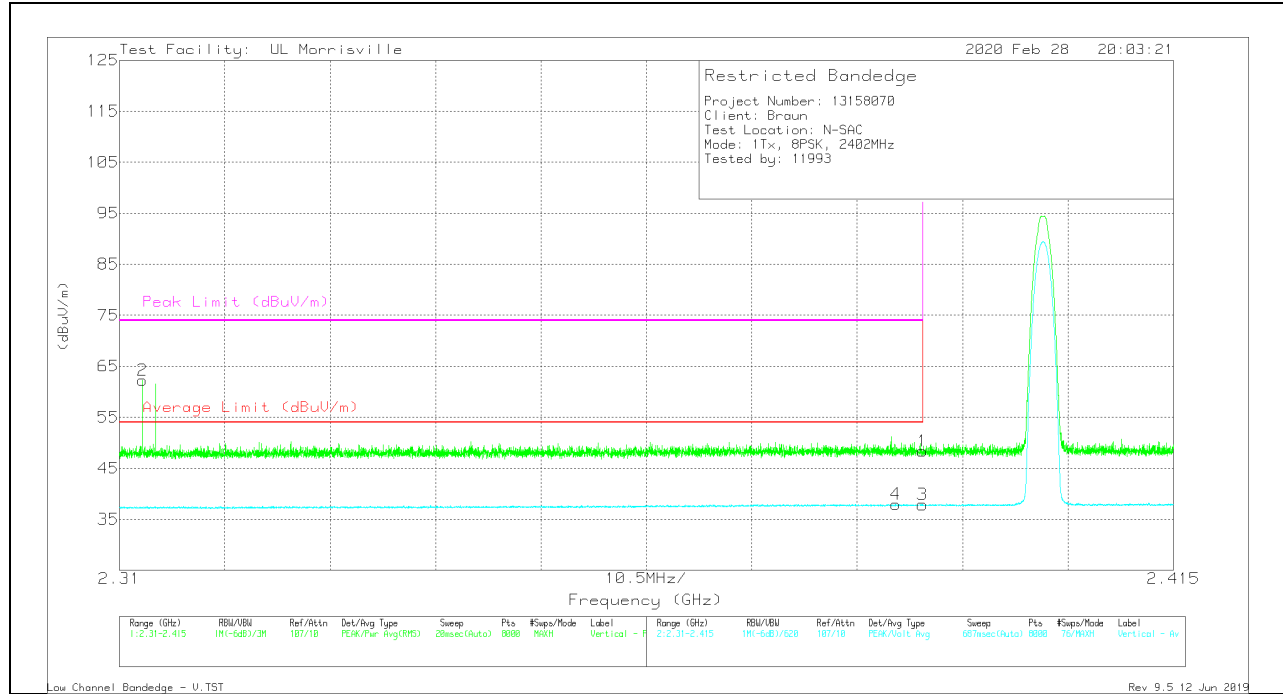
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

V1TV - U-NII: VB=1/Ton, Linear Voltage Average where: Ton is packet duration

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 AF (dBuV/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* ** 2.31228	55.29	Pk	31.7	-24.7	62.29	-	-	74	-11.71	137	215	V
4	* ** 2.38732	30.47	V1TV	32	-24.5	37.97	54	-16.03	-	-	137	215	V
1	* ** 2.39	40.89	Pk	32	-24.5	48.39	-	-	74	-25.61	137	215	V
3	* ** 2.39	30.38	V1TV	32	-24.5	37.88	54	-16.12	-	-	137	215	V

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

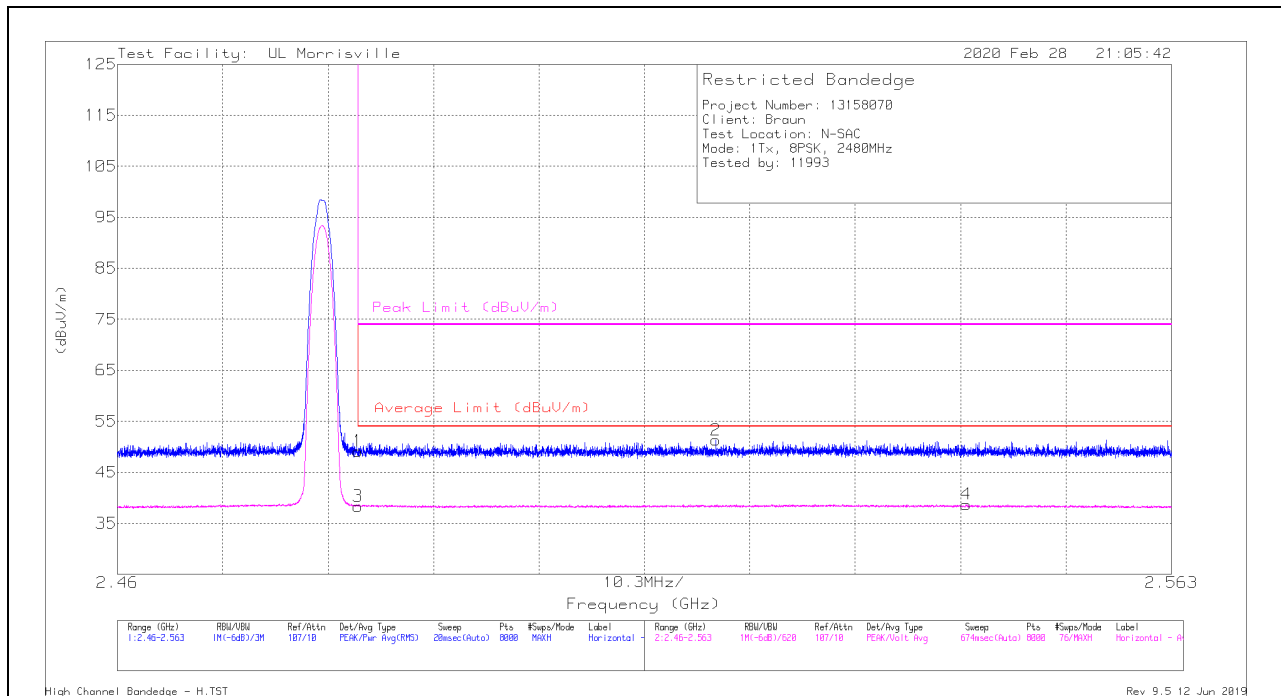
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

V1TV - U-NII: VB=1/Ton, Linear Voltage Average where: Ton is packet duration

BANEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 AF (dBuV/m)	Amp/Cbl/Filtr/Pad (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	41.07	Pk	32.4	-24.3	49.17	-	-	74	-24.83	285	348	H
2	** 2.51849	43.13	Pk	32.5	-24.3	51.33	-	-	74	-22.67	285	348	H
3	* ** 2.4835	30.25	V1TV	32.4	-24.3	38.35	54	-15.65	-	-	285	348	H
4	** 2.54294	30.63	V1TV	32.5	-24.4	38.73	54	-15.27	-	-	285	348	H

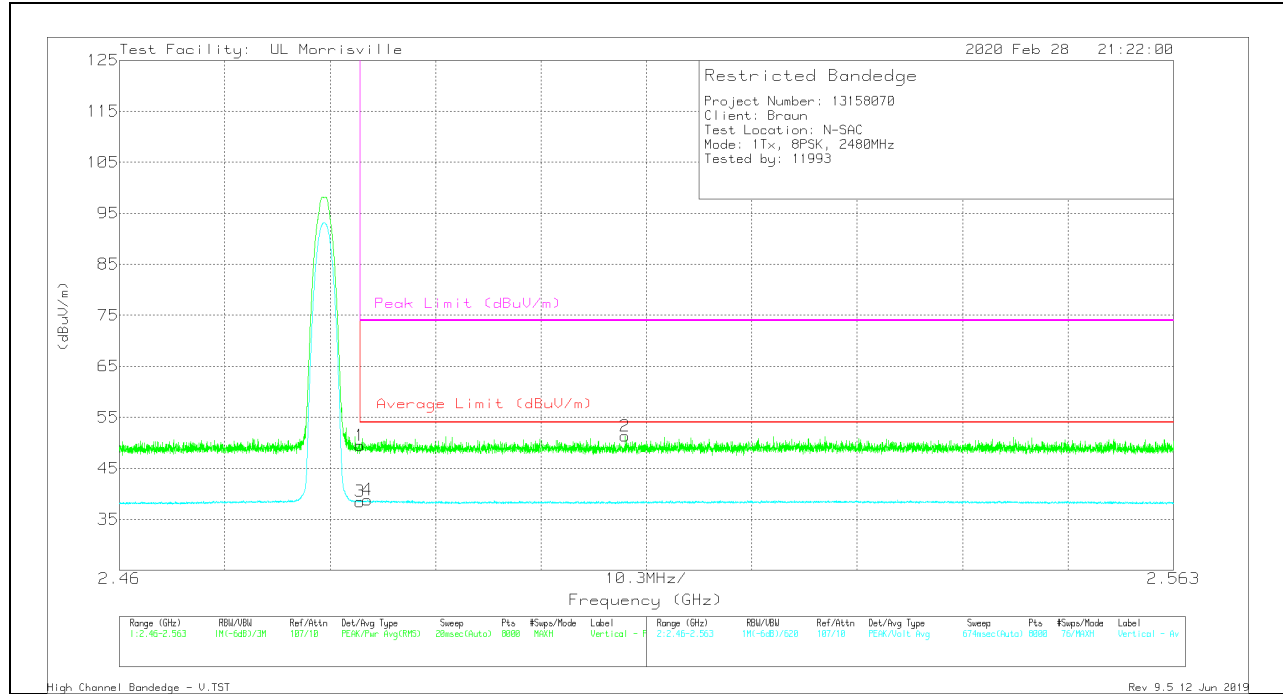
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

V1TV - U-NII: VB=1/Ton, Linear Voltage Average where: Ton is packet duration

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 AF (dBuV/m)	Amp/Cbl/Filtr/Pad (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	41.41	Pk	32.4	-24.3	49.51	-	-	74	-24.49	127	308	V
2	** 2.5094	43.15	Pk	32.5	-24.3	51.35	-	-	74	-22.65	127	308	V
3	* ** 2.4835	30.38	V1TV	32.4	-24.3	38.48	54	-15.52	-	-	127	308	V
4	* ** 2.48425	30.73	V1TV	32.4	-24.3	38.83	54	-15.17	-	-	127	308	V

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

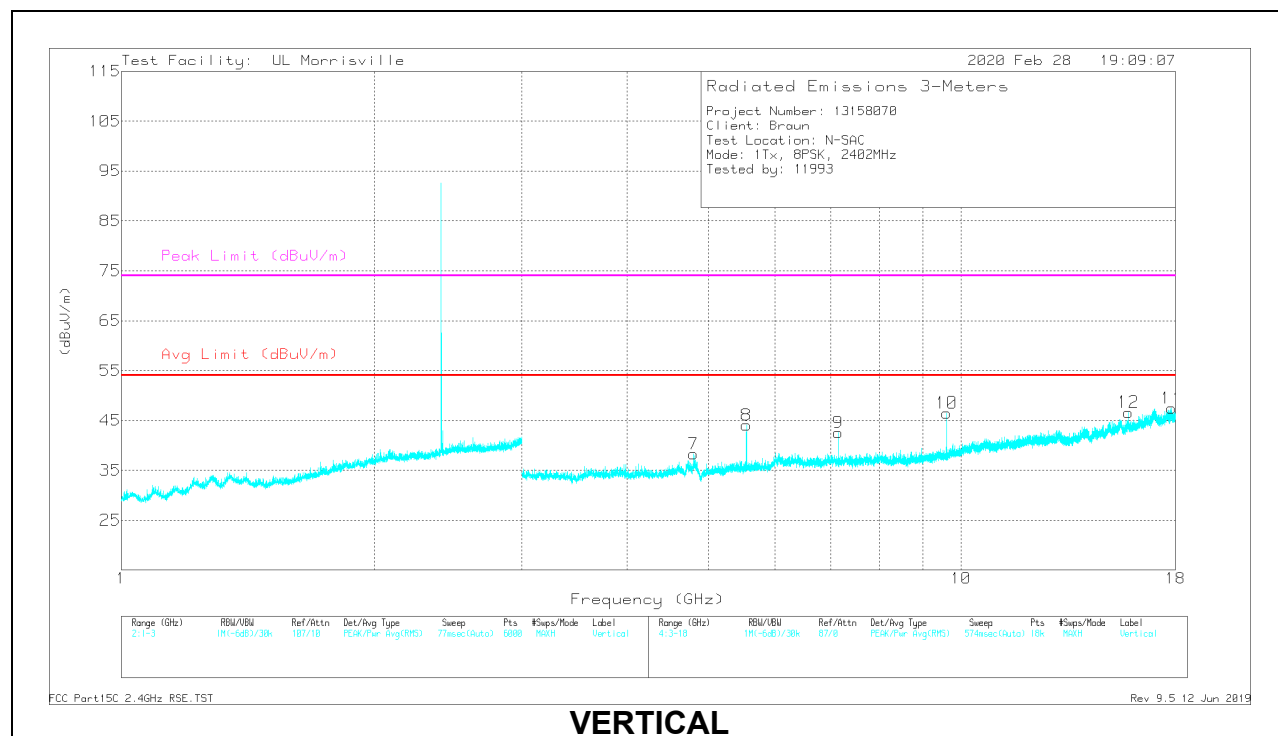
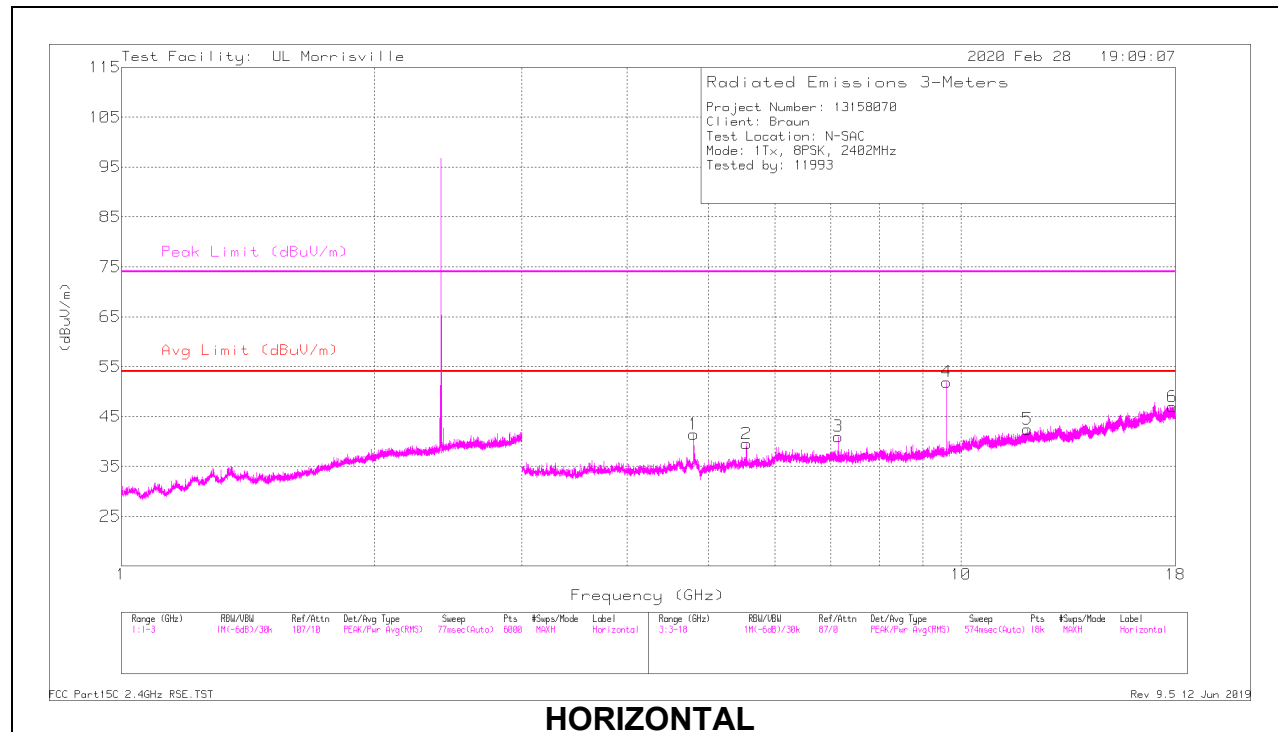
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

V1TV - U-NII: VB=1/Ton, Linear Voltage Average where: Ton is packet duration

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 AF (dBuV/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 4.8039	50.34	PK2	34.1	-31.6	52.84	-	-	74	-21.16	350	111	H
	* ** 4.80395	38.18	V1TV	34.1	-31.6	40.68	54	-13.32	-	-	350	111	H
5	* ** 11.99834	35.1	PK2	38.7	-25.7	48.1	-	-	74	-25.9	299	279	H
	* ** 12.00063	22.99	V1TV	38.7	-25.7	35.99	54	-18.01	-	-	299	279	H
6	* ** 17.83748	34.17	PK2	41	-22.2	52.97	-	-	74	-21.03	304	318	H
	* ** 17.83747	21.9	V1TV	41	-22.2	40.7	54	-13.3	-	-	304	318	H
7	* ** 4.8041	44.01	PK2	34.1	-31.6	46.51	-	-	74	-27.49	339	321	V
	* ** 4.80401	31.21	V1TV	34.1	-31.6	33.71	54	-20.29	-	-	339	321	V
11	* ** 17.81885	34.51	PK2	41.1	-22.1	53.51	-	-	74	-20.49	292	131	V
	* ** 17.82143	22.38	V1TV	41.1	-22.1	41.38	54	-12.62	-	-	292	131	V
12	* ** 15.81793	35.67	PK2	40.2	-24.8	51.07	-	-	74	-22.93	318	395	V
	* ** 15.81851	23.83	V1TV	40.2	-24.9	39.13	54	-14.87	-	-	318	395	V
2	5.55098	37.33	Pk	34.5	-32.3	39.53	-	-	-	-	0-360	102	H
8	5.55098	41.87	Pk	34.5	-32.3	44.07	-	-	-	-	0-360	102	V
3	7.1369	35.3	Pk	35.7	-30	41	-	-	-	-	0-360	102	H
9	7.1369	36.86	Pk	35.7	-30	42.56	-	-	-	-	0-360	102	V
4	9.60787	43.33	Pk	36.6	-28	51.93	-	-	-	-	0-360	102	H
10	9.60787	37.9	Pk	36.6	-28	46.5	-	-	-	-	0-360	198	V

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

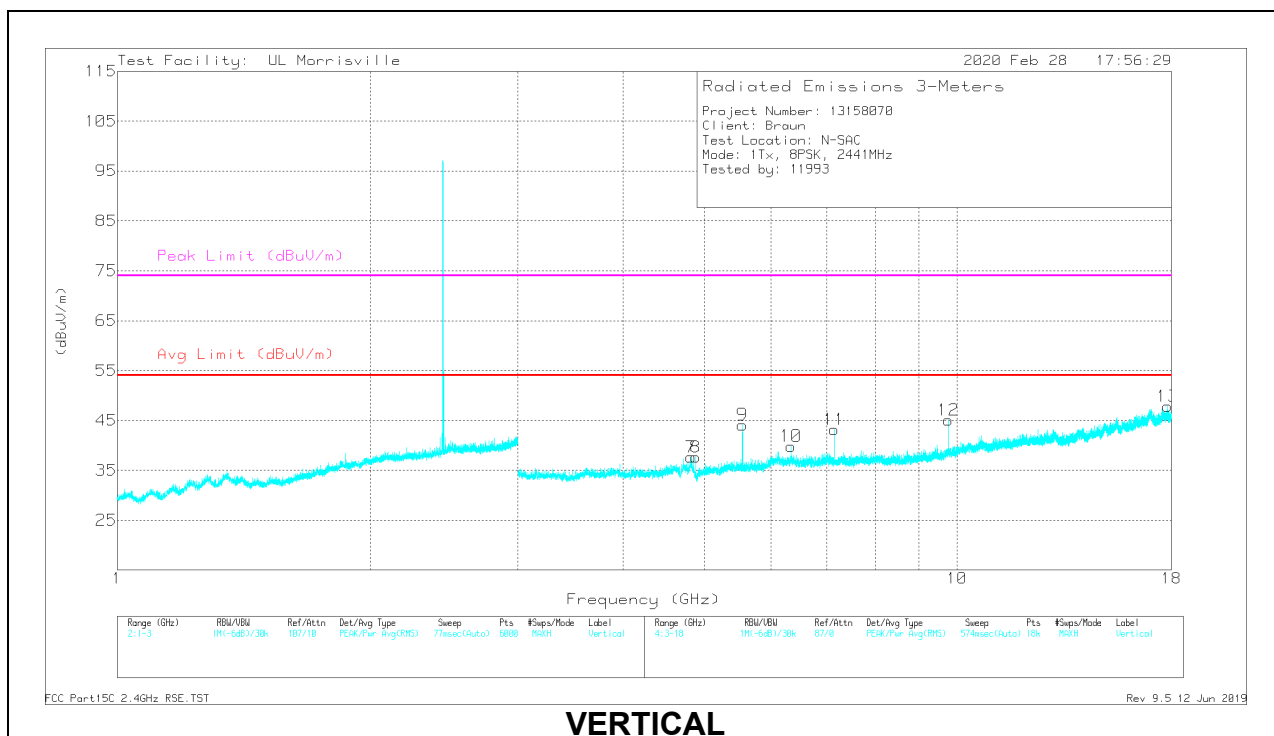
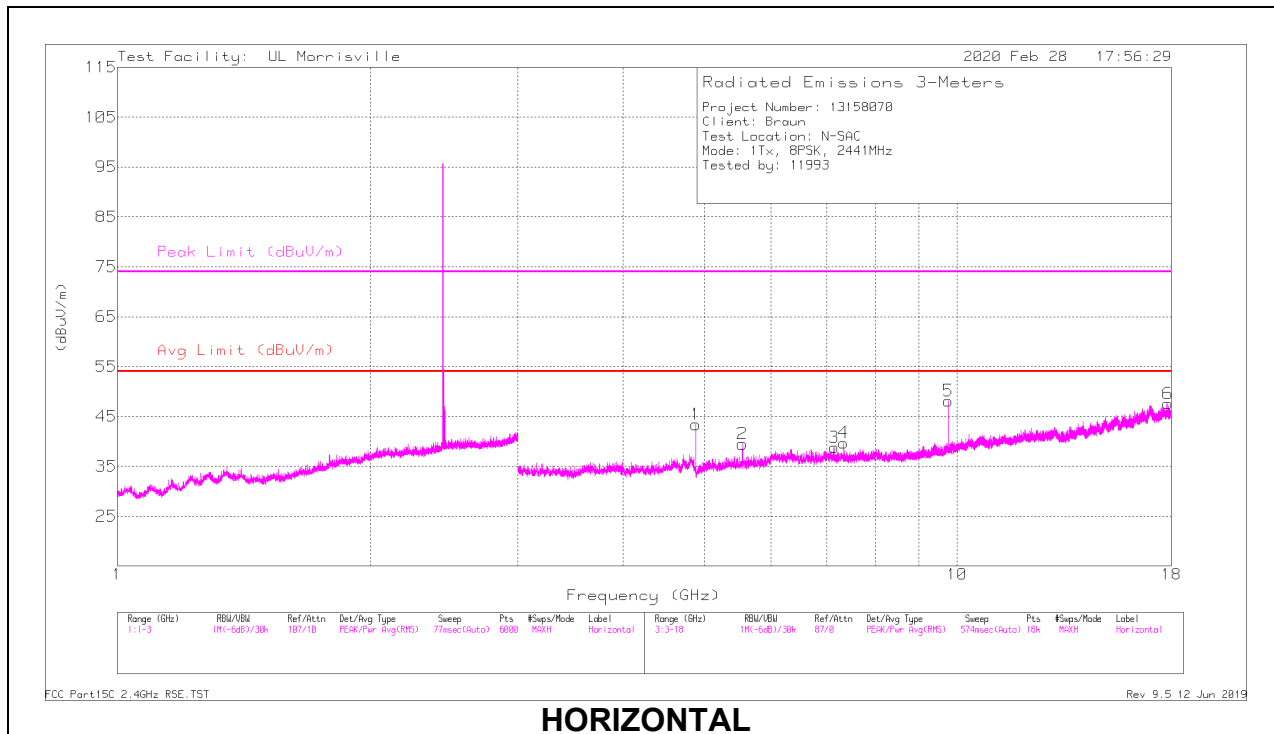
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

PK2 - Maximum Peak

V1TV - VB=1/Ton, Linear Voltage Average where: Ton is packet duration

Pk - Peak detector

MID CHANNEL RESULTS



RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 AF (dBuV/m)	Amp/Cbl/Fitr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 4.88218	49.49	PK2	33.9	-31.3	52.09	-	-	74	-21.91	350	102	H
	* ** 4.88189	38.84	V1TV	33.9	-31.3	41.44	54	-12.56	-	-	350	102	H
4	* ** 7.32293	40.01	PK2	35.6	-29.2	46.41	-	-	74	-27.59	114	163	H
	* ** 7.32293	28.84	V1TV	35.6	-29.2	35.24	54	-18.76	-	-	114	163	H
6	* ** 17.82862	33.69	PK2	41.1	-22.1	52.69	-	-	74	-21.31	170	322	H
	* ** 17.83054	21.98	V1TV	41.1	-22.1	40.98	54	-13.02	-	-	170	322	H
7	* ** 4.82043	42.17	PK2	34.1	-31.5	44.77	-	-	74	-29.23	247	230	V
	* ** 4.82108	29.29	V1TV	34.1	-31.5	31.89	54	-22.11	-	-	247	230	V
8	* ** 4.88206	45.82	PK2	33.9	-31.3	48.42	-	-	74	-25.58	184	327	V
	* ** 4.88195	33.57	V1TV	33.9	-31.3	36.17	54	-17.83	-	-	184	327	V
13	* ** 17.81473	34.51	PK2	41.1	-22.2	53.41	-	-	74	-20.59	313	140	V
	* ** 17.81485	22.24	V1TV	41.1	-22.2	41.14	54	-12.86	-	-	313	140	V
2	5.55098	37.31	Pk	34.5	-32.3	39.51	-	-	-	-	0-360	102	H
9	5.55098	41.93	Pk	34.5	-32.3	44.13	-	-	-	-	0-360	102	V
10	6.34352	34.15	Pk	35.5	-29.8	39.85	-	-	-	-	0-360	198	V
3	7.1369	33.13	Pk	35.7	-30	38.83	-	-	-	-	0-360	102	H
11	7.1369	37.48	Pk	35.7	-30	43.18	-	-	-	-	0-360	102	V
5	9.76371	38.53	Pk	36.8	-27.2	48.13	-	-	-	-	0-360	102	H
12	9.76371	35.51	Pk	36.8	-27.2	45.11	-	-	-	-	0-360	102	V

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

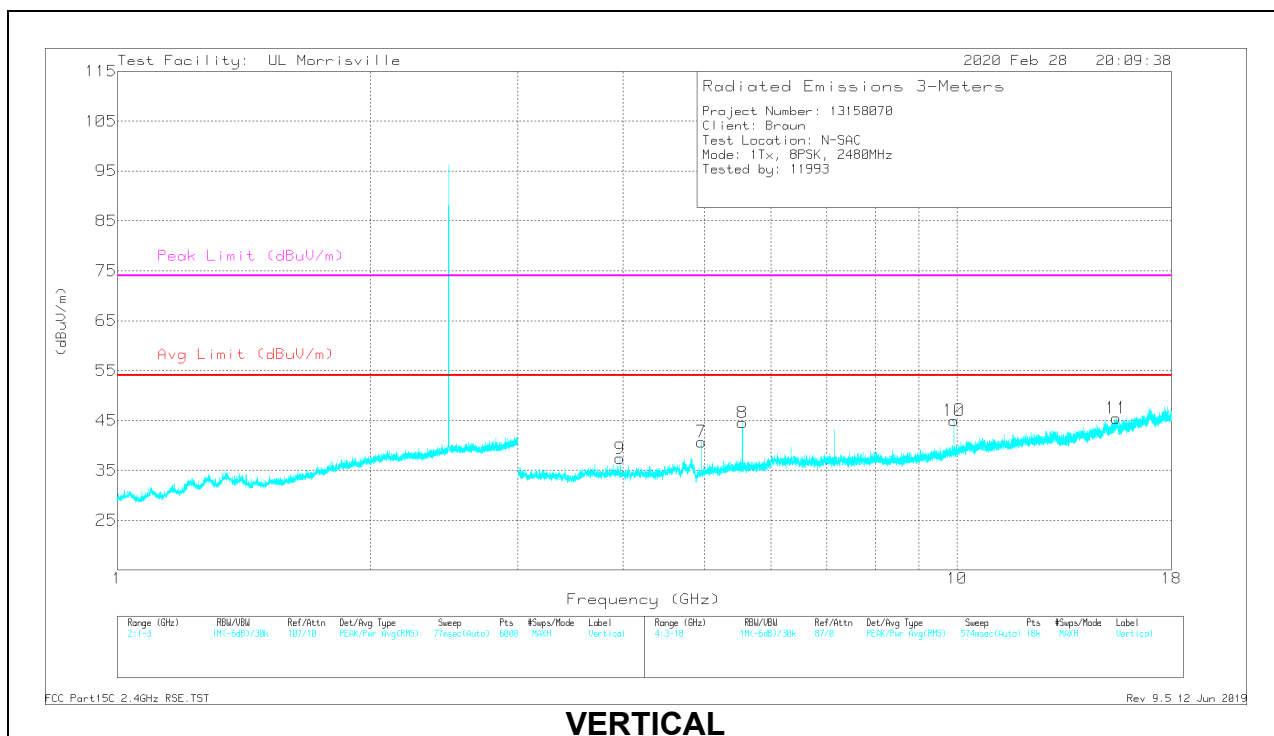
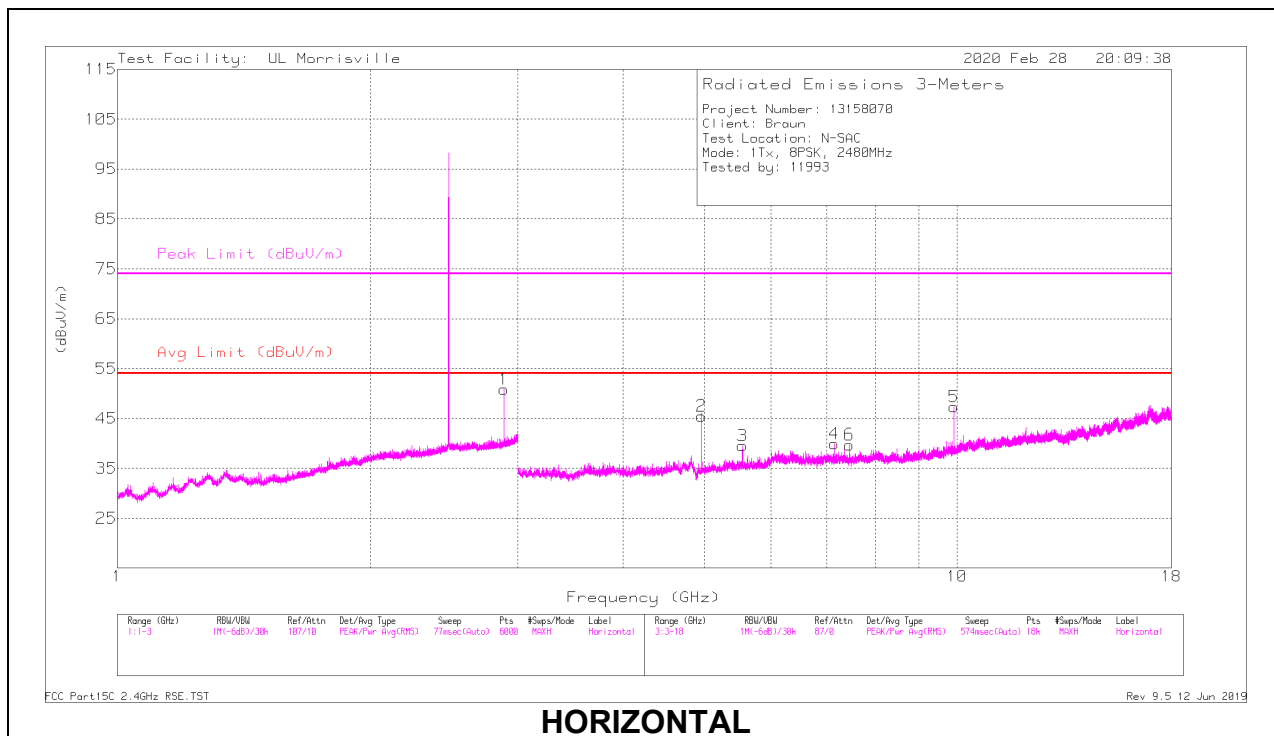
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

PK2 - Maximum Peak

V1TV - VB=1/Ton, Linear Voltage Average where: Ton is packet duration

Pk - Peak detector

HIGH CHANNEL RESULTS



RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 AF (dBuV/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.88808	37.51	PK2	32.6	-23.5	46.61	-	-	74	-27.39	202	300	H
	* ** 2.889	24.65	V1TV	32.6	-23.5	33.75	54	-20.25	-	-	202	300	H
2	* ** 4.95995	52.11	PK2	33.9	-32.3	53.71	-	-	74	-20.29	359	102	H
	* ** 4.95997	40.64	V1TV	33.9	-32.3	42.24	54	-11.76	-	-	359	102	H
6	* ** 7.43996	38.67	PK2	35.6	-29.2	45.07	-	-	74	-28.93	113	217	H
	* ** 7.44006	27.81	V1TV	35.6	-29.2	34.21	54	-19.79	-	-	113	217	H
7	* ** 4.95986	46.81	PK2	33.9	-32.3	48.41	-	-	74	-25.59	136	323	V
	* ** 4.95999	34.49	V1TV	33.9	-32.3	36.09	54	-17.91	-	-	136	323	V
9	* ** 3.96509	39.87	PK2	33.4	-31.7	41.57	-	-	74	-32.43	325	321	V
	* ** 3.9651	28.39	V1TV	33.4	-31.7	30.09	54	-23.91	-	-	325	321	V
11	* ** 15.47148	34.22	PK2	40.1	-23.7	50.62	-	-	74	-23.38	174	387	V
	* ** 15.47123	22.77	V1TV	40.1	-23.7	39.17	54	-14.83	-	-	174	387	V
3	5.55098	37.35	Pk	34.5	-32.3	39.55	-	-	-	-	0-360	102	H
8	5.55098	42.39	Pk	34.5	-32.3	44.59	-	-	-	-	0-360	102	V
4	7.1369	34.2	Pk	35.7	-30	39.9	-	-	-	-	0-360	102	H
5	9.91955	38.03	Pk	37	-27.7	47.33	-	-	-	-	0-360	198	H
10	9.91955	35.71	Pk	37	-27.7	45.01	-	-	-	-	0-360	102	V

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

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

PK2 - Maximum Peak

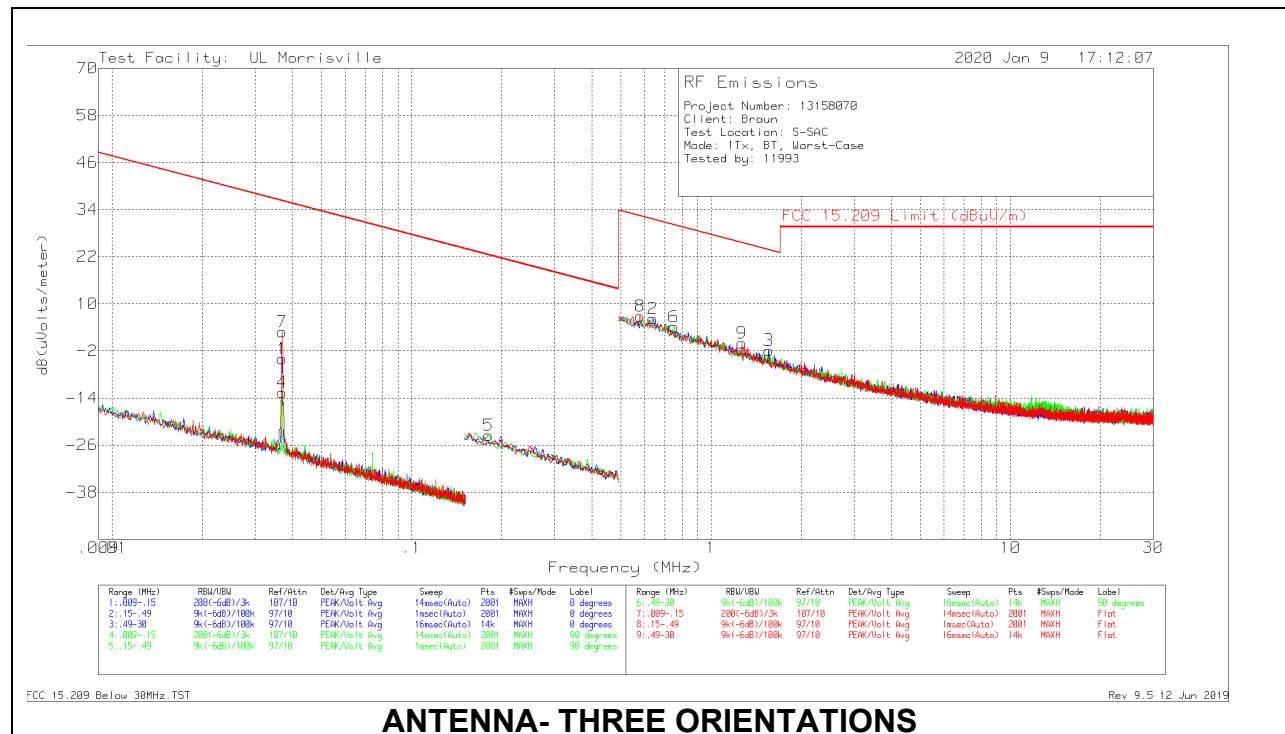
V1TV - VB=1/Ton, Linear Voltage Average where: Ton is packet duration

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*Log (test distance / specification distance).



ANTENNA- THREE ORIENTATIONS

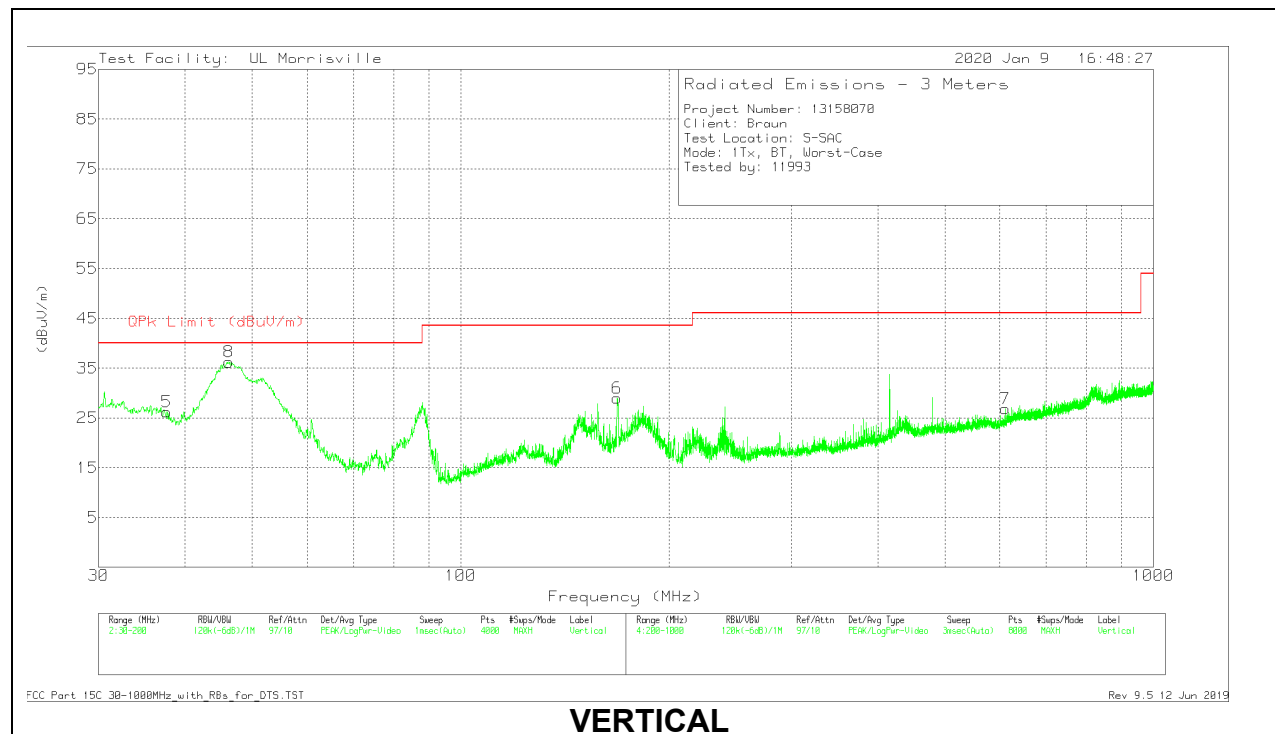
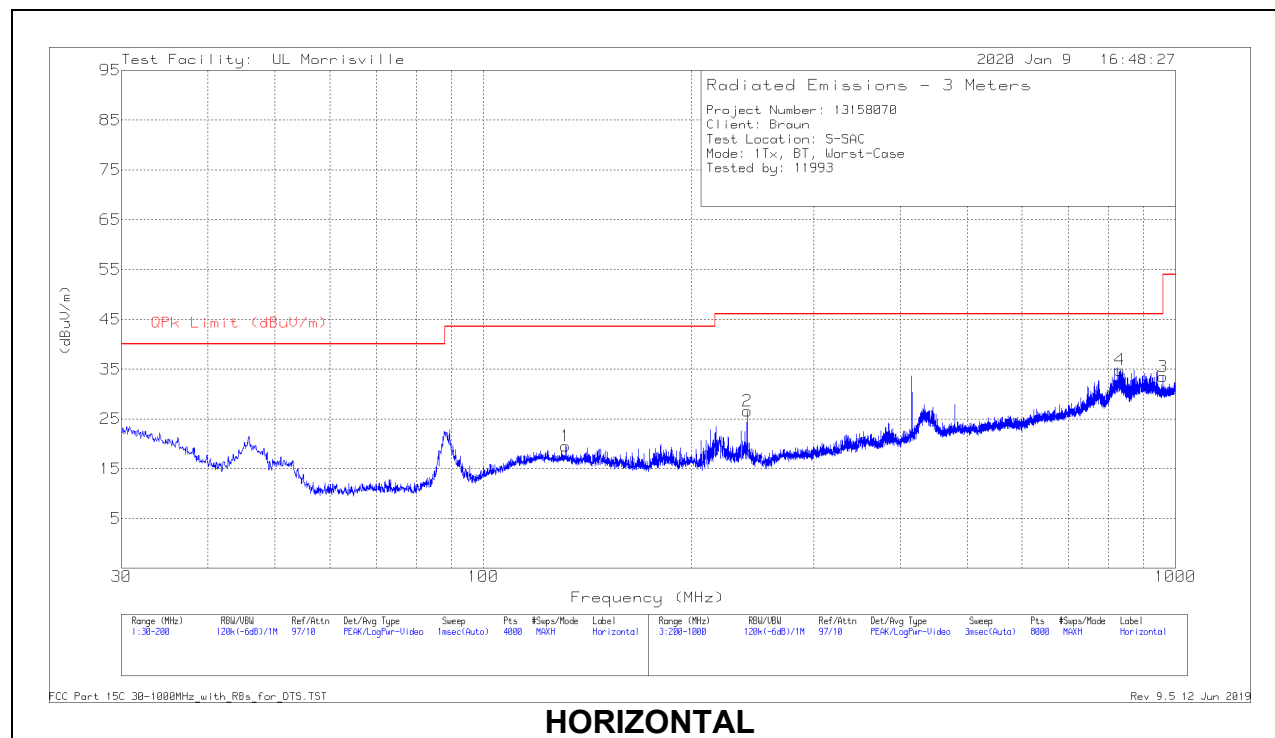
Below 30MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 AF (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.209 QP/AV Limit (dBuV/m)	FCC 15.209 PK Limit (dBuV/m)	Worst-Case Margin (dB)	Azimuth (Degs)	Antenna Face
1	.0369	63.25	Pk	12.6	.1	-80	-4.05	36.26	56.56	-40.31	0-360	On
4	.0369	54.71	Pk	12.6	.1	-80	-12.59	36.26	56.26	-48.85	0-360	Off
7	.0369	70.1	Pk	12.6	.1	-80	2.8	36.26	56.26	-33.46	0-360	Flat
5	.18069	45.38	Pk	11	.1	-80	-23.52	22.47	42.27	-45.99	0-360	Off
8	.58064	35.77	Pk	11	.1	-40	6.87	32.33	-	-25.46	0-360	Flat
2	.63967	35.07	Pk	11	.1	-40	6.17	31.48	-	-25.31	0-360	On
6	.75139	33.03	Pk	11	.1	-40	4.13	30.09	-	-25.96	0-360	Off
9	1.26785	28.67	Pk	11.1	.2	-40	-.03	25.54	-	-25.57	0-360	Flat
3	1.55665	26.8	Pk	11.1	.2	-40	-1.9	23.76	-	-25.66	0-360	On

Pk - Peak detector

9.3. WORST CASE BELOW 1 GHZ

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



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	* ** 131.6013	30.65	Pk	19.7	-30.8	19.55	43.52	-23.97	0-360	198	H
5	* ** 37.652	36.31	Pk	21.6	-31.7	26.21	40	-13.79	0-360	102	V
6	* ** 168.3308	41.24	Pk	18.1	-30.4	28.94	43.52	-14.58	0-360	102	V
2	* ** 240.7053	38.91	Pk	17.7	-30	26.61	46.02	-19.41	0-360	102	H
3	** 959.9988	30.76	Pk	29	-26.3	33.46	46.02	-12.56	0-360	102	H
4	** 831.4821	34.62	Pk	27.9	-27.7	34.82	46.02	-11.2	0-360	102	H
7	* ** 611.3535	30.63	Pk	24.9	-28.7	26.83	46.02	-19.19	0-360	101	V
8	46.2392	52.12	Pk	15.6	-31.5	36.22	-	-	0-360	102	V

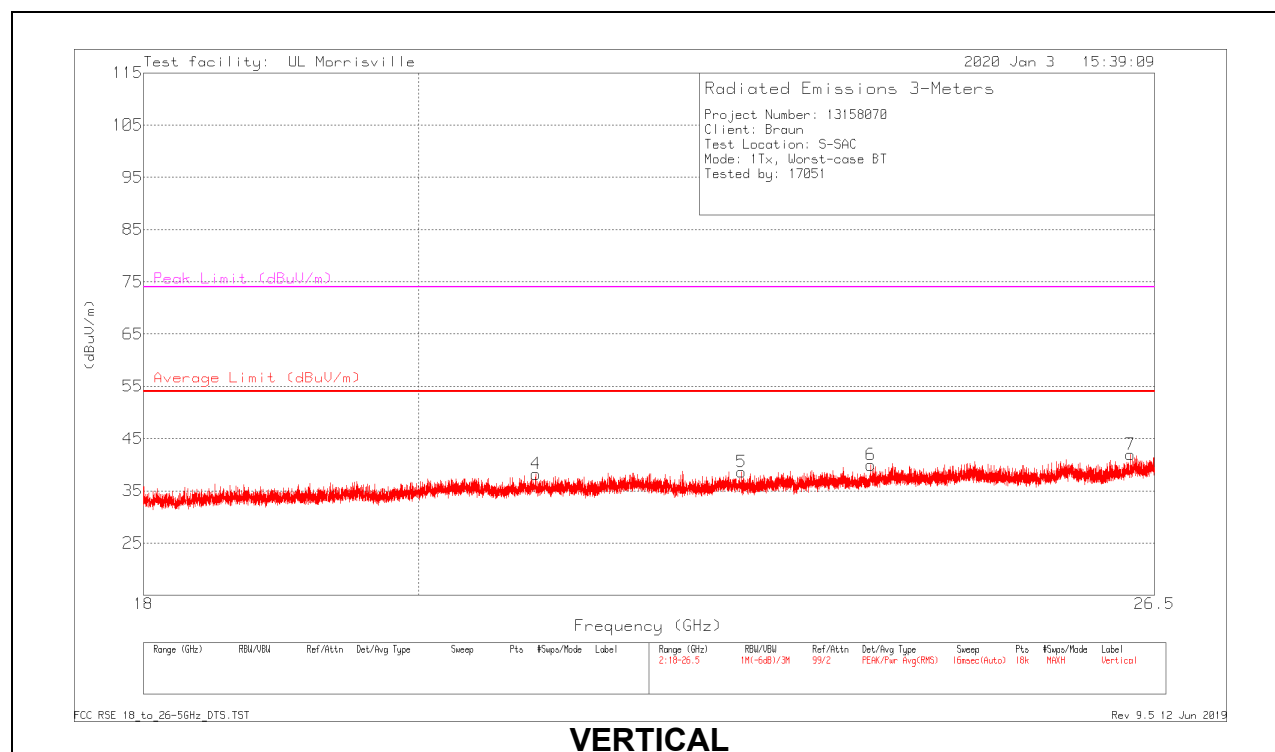
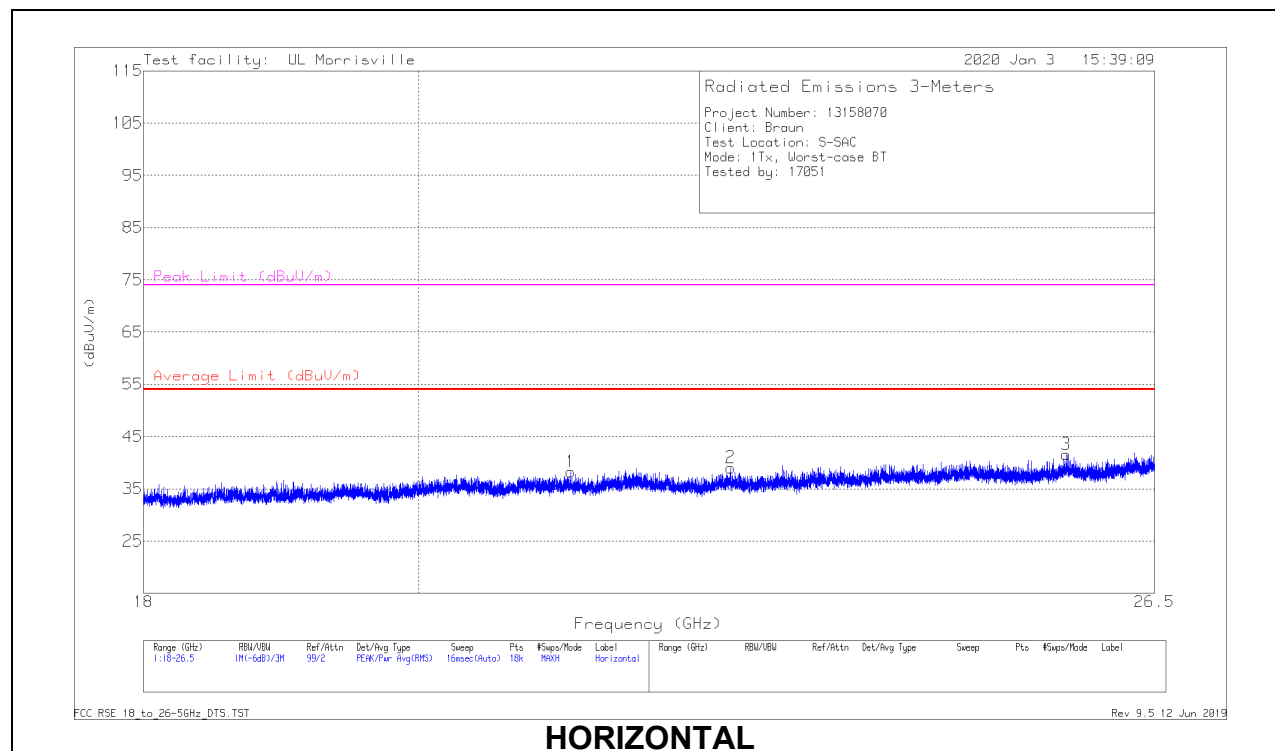
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

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)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 21.19759	39.66	Pk	33.1	-34.5	38.26	54	-15.74	74	-35.74	0-360	148	H
2	* ** 22.53405	39.84	Pk	33.6	-34.4	39.04	54	-14.96	74	-34.96	0-360	248	H
4	* ** 20.91377	39.7	Pk	33.2	-34.7	38.2	54	-15.8	74	-35.8	0-360	152	V
5	* ** 22.62661	39.4	Pk	33.5	-34.3	38.6	54	-15.4	74	-35.4	0-360	252	V
6	* ** 23.77418	39.53	Pk	34	-33.6	39.93	54	-14.07	74	-34.07	0-360	252	V
3	25.62114	40.21	Pk	34.5	-33.1	41.61	54	-12.39	74	-32.39	0-360	198	H
7	26.25773	39.65	Pk	35	-32.7	41.95	54	-12.05	74	-32.05	0-360	298	V

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

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

10. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

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 C63.4.

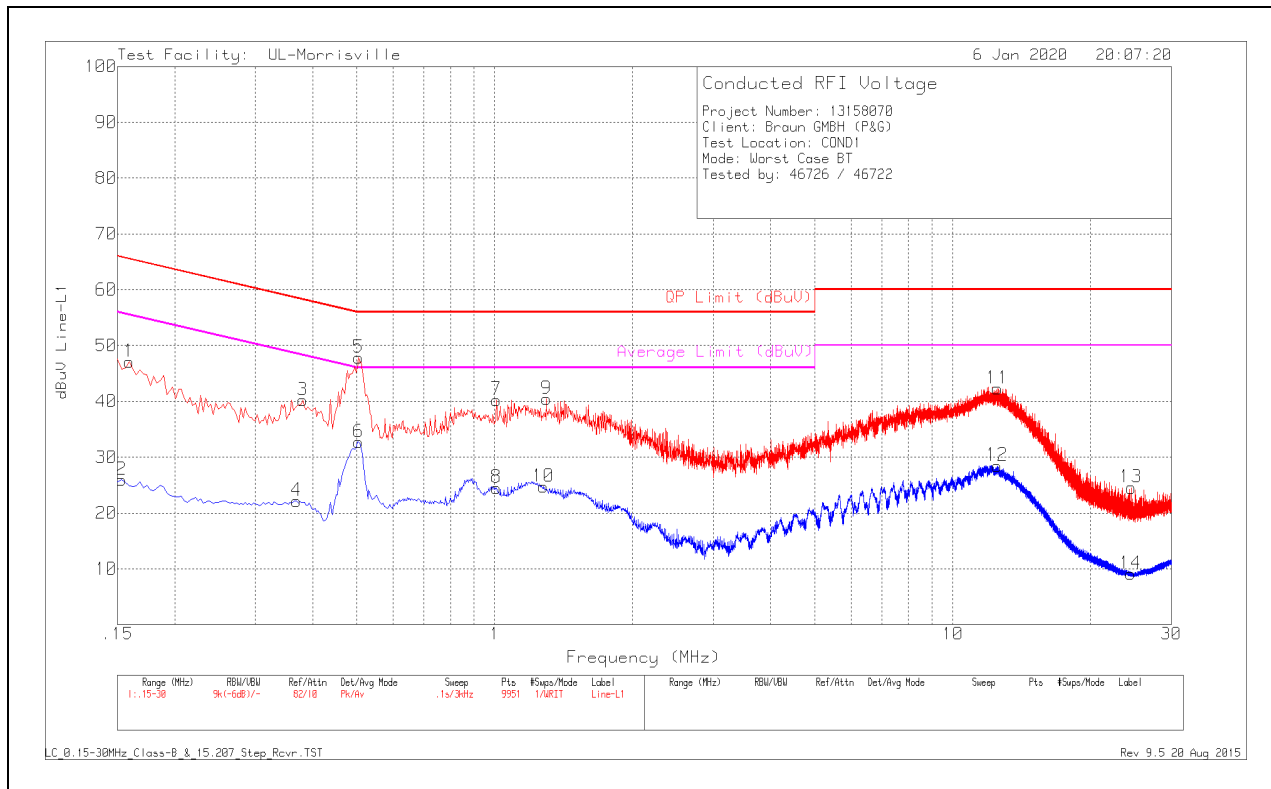
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

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

RESULTS

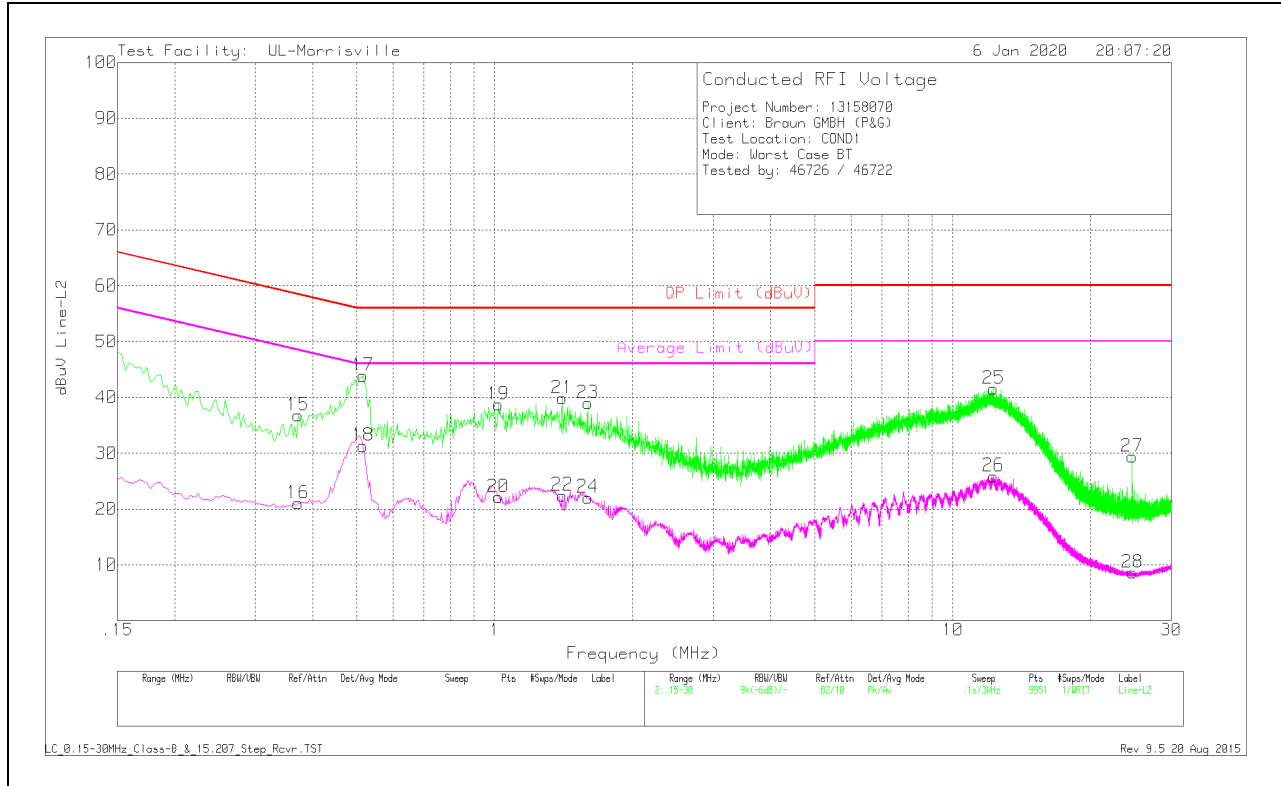
10.1.1. AC Power Line Norm

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	.159	36.87	Pk	.2	10	47.07	65.52	-18.45	-	-
2	.153	15.73	Av	.2	10	25.93	-	-	55.84	-29.91
3	.381	30.11	Pk	.1	10	40.21	58.26	-18.05	-	-
4	.369	12.09	Av	.1	10	22.19	-	-	48.52	-26.33
5	.504	37.76	Pk	.1	10	47.86	56	-8.14	-	-
6	.504	22.62	Av	.1	10	32.72	-	-	46	-13.28
7	1.008	30.25	Pk	0	10	40.25	56	-15.75	-	-
8	1.008	14.53	Av	0	10	24.53	-	-	46	-21.47
9	1.296	30.38	Pk	0	10.1	40.48	56	-15.52	-	-
10	1.278	14.73	Av	0	10	24.73	-	-	46	-21.27
11	12.516	31.79	Pk	.1	10.4	42.29	60	-17.71	-	-
12	12.498	17.97	Av	.1	10.4	28.47	-	-	50	-21.53
13	24.492	13.65	Pk	.2	10.7	24.55	60	-35.45	-	-
14	24.468	-1.81	Av	.2	10.7	9.09	-	-	50	-40.91

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)
15	.372	26.65	Pk	.1	10	36.75	58.46	-21.71	-	-
16	.372	10.9	Av	.1	10	21	-	-	48.46	-27.46
17	.516	33.86	Pk	0	10	43.86	56	-12.14	-	-
18	.516	21.31	Av	0	10	31.31	-	-	46	-14.69
19	1.017	28.72	Pk	0	10	38.72	56	-17.28	-	-
20	1.017	12.17	Av	0	10	22.17	-	-	46	-23.83
21	1.404	29.71	Pk	0	10.1	39.81	56	-16.19	-	-
22	1.404	12.33	Av	0	10.1	22.43	-	-	46	-23.57
23	1.596	28.85	Pk	0	10.1	38.95	56	-17.05	-	-
24	1.596	11.97	Av	0	10.1	22.07	-	-	46	-23.93
25	12.276	31.04	Pk	.1	10.4	41.54	60	-18.46	-	-
26	12.258	15.39	Av	.1	10.4	25.89	-	-	50	-24.11
27	24.636	18.48	Pk	.2	10.7	29.38	60	-30.62	-	-
28	24.669	-2.31	Av	.2	10.7	8.59	-	-	50	-41.41

11. SETUP PHOTOS

Please refer to R13158070-EP2 for setup diagrams

END OF TEST REPORT