

Prüfbericht-Nr.: <i>Test report No.:</i>	50043678 001	Auftrags-Nr.: <i>Order No.:</i>	164053240	Seite 1 von 34 <i>Page 1 of 34</i>
Kunden-Referenz-Nr.: <i>Client reference No.:</i>	466337	Auftragsdatum: <i>Order date.:</i>	12.04.2016	
Auftraggeber: <i>Client:</i>	Lightcomm Technology Co., Ltd. RM 1808 18/F, FO TAN INDUSTRIAL CENTRE, NOS. 26-28 AU PUI WAN STREET, FO TAN SHATIN NEW TERRITORIES HONG KONG			
Prüfgegenstand: <i>Test item:</i>	Bluetooth Portable Speaker			
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	BTS11-E, NS-CSPBTF1-XXX(X="0-9", "A-Z", or blank, Means different color) (INSIGNIA)			
Auftrags-Inhalt: <i>Order content:</i>	FCC and IC approval			
Prüfgrundlage: <i>Test specification:</i>	CFR47 FCC Part 15: Subpart C Section 15.247 CFR47 FCC Part 15: Subpart C Section 15.207 CFR47 FCC Part 15: Subpart C Section 15.209 FCC KDB Publication 447498 v06 CFR47 FCC Part 15: Subpart B Section 15.109 RSS-247 Issue 1 May 2015 RSS-Gen Issue 4 November 2014 ICES-003 Issue 6 January 2016 RSS-102 Issue 5 March 2015			
Wareneingangsdatum: <i>Date of receipt:</i>	12.04.2016			
Prüfmuster-Nr.: <i>Test sample No.:</i>	A000341217-003 to 005			
Prüfzeitraum: <i>Testing period:</i>	12.04.2016 - 13.06.2016			
Ort der Prüfung: <i>Place of testing:</i>	Emtek (Shenzhen) Co., Ltd.			
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland (Shenzhen) Co., Ltd.			
Prüfergebnis*: <i>Test result*:</i>	Pass			
geprüft von / tested by:		kontrolliert von / reviewed by:		
 14.06.2016 Ryan Yang / Senior Project Engineer		 15.06.2016 Owen Tian / Technical Certifier		
Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>
				Unterschrift <i>Signature</i>
Sonstiges / Other:				
FCC ID: XMF-CSPBTF1 IC: 20064-CSPBTF1 HVIN: NS-CSPBTF1				
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>		Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged:</i>		
* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft P(ass) = entspricht o.g. Prüfgrundlage(n) F(all) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor P(ass) = passed a.m. test specifications(s) F(all) = failed a.m. test specifications(s) N/A = not applicable N/T = not tested				
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

Test Summary

5.1.1 ANTENNA REQUIREMENT*RESULT: Pass***5.1.2 MAXIMUM PEAK CONDUCTED OUTPUT POWER***RESULT: Pass***5.1.3 CONDUCTED POWER SPECTRAL DENSITY***RESULT: Pass***5.1.4 6dB BANDWIDTH***RESULT: Pass***5.1.5 99% BANDWIDTH***RESULT: Pass***5.1.6 CONDUCTED SPURIOUS EMISSIONS MEASURED IN 100 KHZ BANDWIDTH***RESULT: Pass***5.1.7 RADIATED SPURIOUS EMISSION***RESULT: Pass***5.1.8 20dB BANDWIDTH***RESULT: Pass***5.1.9 CARRIER FREQUENCY SEPARATION***RESULT: Pass***5.1.10 NUMBER OF HOPPING FREQUENCY***RESULT: Pass***5.1.11 TIME OF OCCUPANCY***RESULT: Pass***5.1.12 CONDUCTED EMISSION***RESULT: Pass***5.1.13 RADIATED EMISSION***RESULT: Pass***6.1.1 ELECTROMAGNETIC FIELDS***RESULT: Pass*

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1 General Remarks

1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:

Appendix A: Test Results of Bluetooth 4.1 (Dual mode) of Conducted Testing

Appendix B: Test Results of Bluetooth 4.1 (Dual mode) of Radiated Testing

2 Test Sites

2.1 Test Facilities

Emtek (Shenzhen) Co., Ltd.

Bldg. 69, Majialong Industry Zone, Nanshan District, Shenzhen Guangdong, China

FCC Registration No.: 406365

Test site Industry Canada No.: 4480A-2

The tests at the test sites have been conducted under the supervision of a TÜV engineer.

2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

Emtek (Shenzhen) Co., Ltd.

Radio Spectrum Test				
Equipment	Manufacturer	Model No.	Serial No.	Cal. Until
Spectrum Analyzer	R&S	FSV40	132.1-3008K39-100967-AP	17.05.2017
Spectrum Analyzer	Agilent	E4407B	88156318	17.05.2017
Spectrum Analyzer	Agilent	N9010A	My53470879	17.05.2017
Conducted Emission				
Equipment	Manufacturer	Model No.	Serial No.	Cal. Until
Test Receiver	R&S	ESCI	26115-010-0027	17.05.2017
L.I.S.N.	R&S	ENV216	101161	17.05.2017
50Ω Coaxial Switch	Anritsu	MP59B	6100175589	17.05.2017
Voltage Probe	R&S	ESH2-Z3	100122	17.05.2017
Radiated Emission & Spurious Emission				
Equipment	Manufacturer	Model No.	Serial No.	Cal. Until
EMI Test Receiver	R&S	ESU	1302.6005.26	17.05.2017
Loop Antenna	Schwarzbeck	FMZB 1519	1519-012	17.05.2017
Pre-Amplifier	HP	8447F	2944A07999	17.05.2017
Bilog Antenna	Schwarzbeck	VULB9163	142	17.05.2017
Pre-Amplifier	A.H.	PAM-0126	1415261	17.05.2017
Horn Antenna	Schwarzbeck	BBHA 9120	707	17.05.2017
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170399	17.05.2017
Cable	N/A	3M SF104-26.5	295838/4	17.05.2017
Cable	N/A	6M SF104-26.5	295840/4	17.05.2017
Cable	Schwarzbeck	AK9513	ACRX1	17.05.2017
Cable	Rosenberger	N/A	FP2RX2	17.05.2017
Cable	Schwarzbeck	AK9513	CRPX1	17.05.2017
Cable	Schwarzbeck	AK9513	CRRX2	17.05.2017
Cable	H+B	0.5M SF104-26.5	289147/4	17.05.2017
Cable	H+B	3M SF104-26.5	295838/4	17.05.2017
Cable	H+B	6M SF104-26.5	295840/4	17.05.2017

2.3 Traceability

All measurement equipment calibrations are traceable to NIM (National Institute of Metrology) or where calibration is performed in other countries, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically by the manufacturer or according to manufacturer's specifications. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

2.5 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements as below table

Item	Extended Uncertainty
Radio Spectrum	± 1.0 dB
All emission, radiated	± 3.0 dB
Conducted Emission	± 2.0 dB
Radiated Emission	± 2.0 dB
Antenna Port Emission	± 3.0 dB
Temperature	± 0.5 °C
Humidity	± 3.0 %

2.6 Location of Original Data

The original copies of all test data taken during actual testing were attached at Appendix A & B of this report and delivered to the applicant. A copy has been retained in the TÜV Rheinland (Shenzhen) file for certification follow-up purposes.

2.7 Status of Facility Used for Testing

The Emtex (Shenzhen) Co., Ltd. Test facility located at Bldg. 69, Majialong Industry Zone, Nanshan District, Shenzhen Guangdong, China is listed on the US Federal Communications Commission list of facilities approved to perform measurements.

3 General Product Information

3.1 Product Function and Intended Use

The EUT is a 'Bluetooth Portable Speaker' device. It supports Bluetooth 4.1 (Dual mode) wireless technology.

According to the declaration of the applicant, the electrical circuit design, PCB layout and components used are identical for all models, only the model No. and appearance are different.

For details refer to the User Manual, Technical Description and Circuit Diagram.

3.2 Ratings and System Details

Table 2: Technical Specification of EUT

Technical Specification	Value
Kind of Equipment	Bluetooth Portable Speaker
Type Designation	BTS11-E, NS-CSPBTF1-XXX(X="0-9", "A-Z", or blank, Means different color)
Trade Mark	INSIGNIA
FCC ID	XMF-CSPBTF1
IC	20064-CSPBTF1
HVIN	NS-CSPBTF1
Operating Frequency	2402 - 2480 MHz
Operating Temperature Range	0 °C ~ +35 °C
Operating Voltage	DC 3.7V via internal rechargeable lithium battery DC 5.0V via USB port for charging
Testing Voltage	DC 3.7V via internal rechargeable lithium battery DC 5.0V via USB port for charging
Type of Modulation	GFSK, $\pi/4$ DQPSK, 8DPSK
Channel Number	BDR & EDR mode:79 channels; Low Energy mode:40 channels
Channel Separation	BDR & EDR mode:1MHz; Low Energy mode:2MHz
Wireless Technology	Bluetooth 4.1 (Dual mode)
Antenna Type	PCB Antenna
Antenna Gain	0.00 dBi

Table 3: RF Channel and Frequency of Bluetooth

RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)
00	2402.00	20	2422.00	40	2442.00	60	2462.00
01	2403.00	21	2423.00	41	2443.00	61	2463.00
02	2404.00	22	2424.00	42	2444.00	62	2464.00
03	2405.00	23	2425.00	43	2445.00	63	2465.00
04	2406.00	24	2426.00	44	2446.00	64	2466.00
05	2407.00	25	2427.00	45	2447.00	65	2467.00
06	2408.00	26	2428.00	46	2448.00	66	2468.00
07	2409.00	27	2429.00	47	2449.00	67	2469.00
08	2410.00	28	2430.00	48	2450.00	68	2470.00
09	2411.00	29	2431.00	49	2451.00	69	2471.00
10	2412.00	30	2432.00	50	2452.00	70	2472.00
11	2413.00	31	2433.00	51	2453.00	71	2473.00
12	2414.00	32	2434.00	52	2454.00	72	2474.00
13	2415.00	33	2435.00	53	2455.00	73	2475.00
14	2416.00	34	2436.00	54	2456.00	74	2476.00
15	2417.00	35	2437.00	55	2457.00	75	2477.00
16	2418.00	36	2438.00	56	2458.00	76	2478.00
17	2419.00	37	2439.00	57	2459.00	77	2479.00
18	2420.00	38	2440.00	58	2460.00	78	2480.00
19	2421.00	39	2441.00	59	2461.00	--	--

Table 4: RF Channel and Frequency of Bluetooth Low Energy

RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)
00	2402.00	10	2424.00	20	2444.00	30	2464.00
01	2404.00	11	2426.00	21	2446.00	31	2466.00
02	2406.00	12	2428.00	22	2448.00	32	2468.00
03	2408.00	13	2430.00	23	2450.00	33	2470.00
04	2410.00	14	2432.00	24	2452.00	34	2472.00
05	2412.00	15	2434.00	25	2454.00	35	2474.00
06	2414.00	16	2436.00	26	2456.00	36	2476.00
07	2416.00	17	2438.00	27	2458.00	37	2478.00
08	2418.00	18	2440.00	28	2460.00	38	2480.00
09	2420.00	19	2442.00	29	2462.00	--	--

Table 5: Frequency Hopping Information

Technical Specification	Description
Hopping Range	Hereby we declare that the maximum frequency of this device is: 2402-2480MHz. This is according the Bluetooth Core Specification V2.1 + EDR for devices which will be operated in the USA. This was checked during the Bluetooth Qualification tests (Test Case: TRM/CA/04-E).
Hopping Sequence	Example of a 79 hopping sequence in data mode: 33,04,21,44,23,42,53,46,55,48,40,59,72,29,76,31,08,73,07,75,09,45,60,39,58,13,47,11,77,52,35,50,65,54,67,56,69,62,71,64, 7,25,27,66,57,70,74,61,78,63,10,41,05,43,15,44,64,68,02,70,06,01,51,03,55,05,03,66,53,49,36,47,
Receiver input bandwidth	<p>The input bandwidth of the receiver is 1MHz. In every connection one Bluetooth device is the master and the other one is the slave. The master determines the hopping sequence. The slave follows this sequence. Both devices shift between RX and TX time slot according to the clock of the master.</p> <p>Additionally the type of connection is set up at the beginning of the connection. The master adapts its hopping frequency and its TX/RX timing according to the packet type of the connection. Also the slave of the connection will use these settings.</p> <p>Repeating of a packer has no influence on the hopping sequence. The hopping sequence generated by the master of the connection will be followed in any case.</p> <p>That means a repeated packet will not be send on the same frequency, it is send on the next frequency of the hopping sequence.</p>

3.3 Independent Operation Modes

The basic operation modes are:

- A. On
 - 1. Bluetooth mode (BDR & EDR mode)
 - a. Transmitting
 - 1) Low Channel
 - 2) Middle Channel
 - 3) High Channel
 - b. Receiving
 - 2. Bluetooth mode (Low Energy mode)
 - a. Transmitting
 - 1) Low Channel
 - 2) Middle Channel
 - 3) High Channel
 - b. Receiving
- B. On, Transmitting on Hopping channel
- C. On, Bluetooth connecting mode
- D. Aux in mode
- E. Charging mode
- F. Off

3.4 Noise Generating and Noise Suppressing Parts

Refer to Circuit Diagram for further details.

3.5 Submitted Documents

- Application Form
- Block Diagram
- FCC/IC Label and Location Info
- Model Difference Letter
- Operation Description
- Parts List
- PCB Layout
- Photo Document
- Schematics
- User Manual

4 Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

Radio Spectrum: The equipment under test (EUT) was configured at its highest power output in order to measure its highest possible radiation and conducted level. The test modes were adapted accordingly in reference to the instructions for use.

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the instructions for use.

4.2 Test Operation and Test Software

Test operation refers to test setup in chapter 5. All testing were performed according to the procedures in ANSI C63.10: 2013 and ANSI C63.4: 2014

According to clause 3.1, all tests were performed on model BTS11-E in this report.

4.3 Special Accessories and Auxiliary Equipment

Table 6: List of Accessories and Auxiliary Equipment

Description	Manufacturer	Model	S/N	Rating
Iphone5C	Apple	A1526	N/A	N/A
Adapter	SIMSUKIAN	SK22G-0500200U	N/A	N/A
Adapter	TPT	MIL050150U	N/A	N/A

4.4 Countermeasures to Achieve EMC Compliance

The test sample which has been tested contained the noise suppression parts as described in the Technical Construction File (TCF).

No additional measures were employed to achieve compliance.

4.5 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test (Below 1GHz)

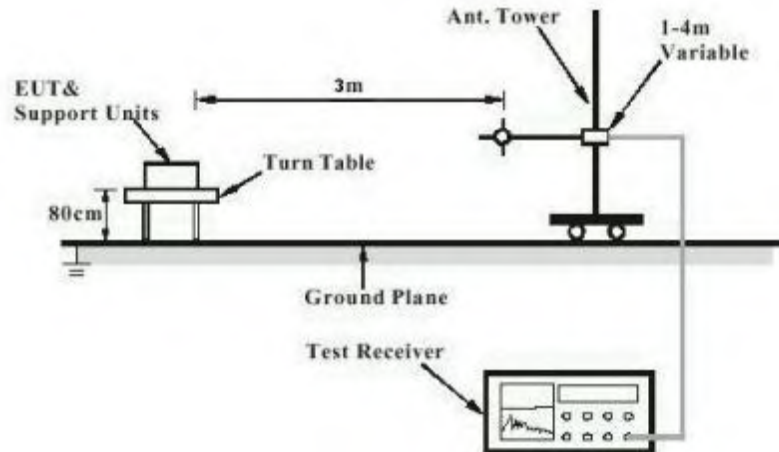


Diagram of Measurement Configuration for Radiation Test (Above 1GHz)

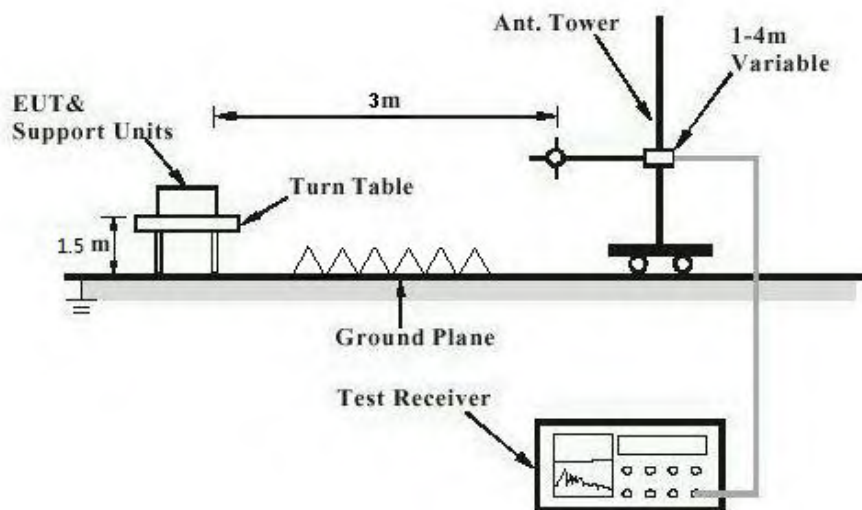


Diagram of Measurement Configuration for Mains Conduction Measurement

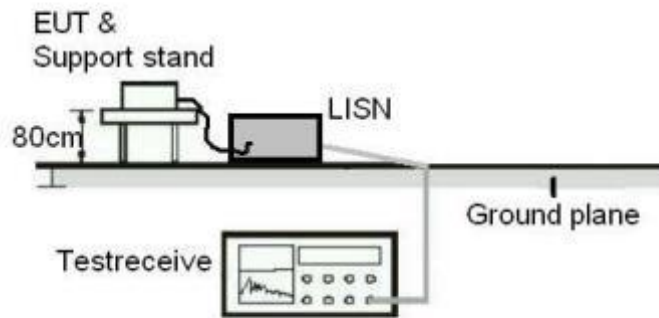
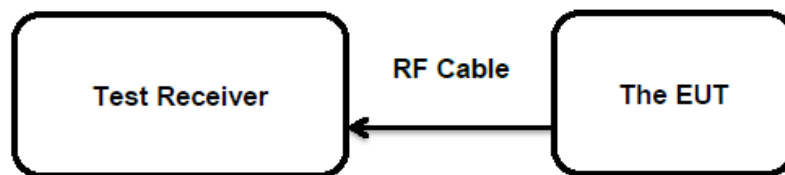


Diagram of Measurement Configuration for Conducted Transmitter Measurement



5 Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT:

Pass**Test Specification**

Test standard : FCC Part 15.247(b)(4) and Part 15.203
RSS-Gen Clause 6.7

According to the manufacturer declared, the EUT has an internal antenna, the directional gain of antenna is 0.00 dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement. Therefore the EUT is considered sufficient to comply with the provision.

Therefore the EUT is considered sufficient to comply with the provision.

Refer to EUT Photo for further details.

5.1.2 Maximum Peak Conducted Output Power

RESULT:
Pass
Test Specification

Test standard	: FCC Part 15.247(b)(1)&(3) RSS-247 Clause 5.4(2)&(4)
Basic standard	: ANSI C63.10: 2013
Limits	: FHSS < 0.125 Watts, DSSS < 1.0 Watts
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 13.06.2016
Input voltage	: DC 5.0V via USB port for charging
Operation mode	: A.1.a, A.2.a
Test channel	: Low / Middle / High
Ambient temperature	: 25 °C
Relative humidity	: 56 %
Atmospheric pressure	: 101 kPa

Table 7: Test Result of Maximum Peak Conducted Output Power

Test Mode	Channel Frequency (MHz)	Measured Peak Output Power		Limit (W)
		(dBm)	(W)	
BDR	2402	4.547	0.00285	< 0.125
	2441	4.046	0.00254	
	2480	3.790	0.00239	
EDR	2402	4.462	0.00279	< 0.125
	2441	4.457	0.00279	
	2480	4.257	0.00267	
Low Energy	2402	4.806	0.00302	< 1.0
	2440	4.126	0.00259	
	2480	3.993	0.00251	
Maximum Measured Value		4.81	0.00302	/

Note: The cable loss is taken into account in results.

For the measurement records, refer to the appendix A.

5.1.3 Conducted Power Spectral Density

RESULT:

Pass

Test Specification

Test standard : FCC Part 15.247(e)
RSS-247 Clause 5.2(2)
Basic standard : ANSI C63.10: 2013
Limits : 8 dBm/3kHz
Kind of test site : Shielded Room

Test Setup

Date of testing : 13.06.2016
Input voltage : DC 5.0V via USB port for charging
Operation mode : A.2.a
Test channel : Low / Middle / High
Ambient temperature : 25 °C
Relative humidity : 56 %
Atmospheric pressure : 101 kPa

Table 8: Test Result of Power Spectral Density, Low Energy

Test Mode	Test Channel (MHz)	Power Spectrum Density(dBm/3kHz)	Limit (dBm/3kHz)
Low Energy	2402	-9.151	< 8.0
	2440	-9.869	
	2480	-10.009	
Maximum Measured Value		-9.15	

Note: The cable loss is taken into account in results.

For the measurement records, refer to the appendix A.

5.1.4 6dB Bandwidth

RESULT:
Pass
Test Specification

Test standard : FCC Part 15.247(a)(2)
RSS-247 Clause 5.2(1)

Basic standard : ANSI C63.10: 2013

Limits : More than 500 KHz

Kind of test site : Shielded Room

Test Setup

Date of testing : 03.05.2016

Input voltage : DC 5.0V via USB port for charging

Operation mode : A.2.a

Test channel : Low / Middle / High

Ambient temperature : 25 °C

Relative humidity : 56 %

Atmospheric pressure : 101 kPa

Table 9: Test Result of 6dB Bandwidth, Low Energy

Test Mode	Test Channel (MHz)	-6dB Bandwidth (kHz)	Limit (kHz)
Low Energy	2402	752.40	> 500
	2440	771.90	
	2480	734.30	
Minimum Measured Value		734.30	

Note: The cable loss is taken into account in results.

For the measurement records, refer to the appendix A.

5.1.5 99% Bandwidth

RESULT:
Pass
Test Specification

Test standard : RSS-Gen Clause 6.6
 Basic standard : ANSI C63.10: 2013
 Kind of test site : Shielded Room

Test Setup

Date of testing : 03.05.2016
 Input voltage : DC 5.0V via USB port for charging
 Operation mode : A.1.a, A.2.a
 Test channel : Low / Middle / High
 Ambient temperature : 25 °C
 Relative humidity : 56 %
 Atmospheric pressure : 101 kPa

Table 10: Test Result of 99% Bandwidth

Test Mode	Channel Frequency (MHz)	99% Bandwidth (kHz)	Limit (kHz)
BDR	2402	913.69	/
	2441	915.33	
	2480	915.81	
EDR	2402	1177.70	/
	2441	1182.90	
	2480	1202.40	
Low Energy	2402	1089.30	/
	2440	1080.50	
	2480	1076.30	
Maximum Measured Value		1202.40	/

Note: The cable loss is taken into account in results.

For the measurement records, refer to the appendix A.

5.1.6 Conducted Spurious Emissions Measured in 100 kHz Bandwidth

RESULT: **Pass****Test Specification**

Test standard	: FCC Part 15.247(d) RSS-247 Clause 5.5
Basic standard	: ANSI C63.10: 2013
Limits	: 20dB (below that in the 100kHz bandwidth within the band that contains the highest level of the desired power); In addition, radiated emissions which fall in the restricted bands, must also comply with the radiated emission limits specified in 15.209(a)
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 03.05.2016
Input voltage	: DC 5.0V via USB port for charging
Operation mode	: A.1,a, A.2.a
Test channel	: Low / Middle / High
Ambient temperature	: 25 °C
Relative humidity	: 56 %
Atmospheric pressure	: 101 kPa

Test results of 100kHz Bandwidth of Frequency Band Edge by Conducted method refer to following test plot, and compliance is achieved as well.

For the measurement records, refer to the appendix A.

5.1.7 Radiated Spurious Emission

RESULT:**Pass****Test Specification**

Test standard	: FCC Part 15.247(d) & FCC Part 15.205 RSS-247 Clause 3.3
Basic standard	: ANSI C63.10: 2013
Limits	: Refer to 15.209(a) of FCC part 15.247(d) RSS-Gen Table 4 & Table 5
Kind of test site	: 3m Semi-anechoic Chamber

Test Setup

Date of testing	: 05.05.2016
Input voltage	: DC 3.7V via internal rechargeable lithium battery
Operation mode	: A.1,a, A.2.a
Test channel	: Low / Middle / High
Ambient temperature	: 25 °C
Relative humidity	: 56 %
Atmospheric pressure	: 101 kPa

Remark:

During the pretest the EUT was rotated through three orthogonal axes to determine the attitude that maximizes the emissions. After that the EUT was manually handled to find the orientation that has the maximum emission, which is the orientation shown in the test set-up photos.

Pre-test the EUT in continuous transmitting mode at the low (2402 MHz), middle (2441 MHz) and high (2480 MHz) channel with different data packet. Compliance test in continuous transmitting mode with BDR mode (DH5) as the worst case was found.

Testing was carried out within frequency range 9kHz to the tenth harmonics.

For the measurement records, refer to the appendix B.

5.1.8 20dB Bandwidth

RESULT:
Pass
Test Specification

Test standard : FCC Part 15.247(a)(1)
 : RSS-247 Clause 5.1(1)
 Basic standard : ANSI C63.10: 2013
 Kind of test site : Shielded Room

Test Setup

Date of testing : 03.05.2016
 Input voltage : DC 3.7V via internal rechargeable lithium battery
 Operation mode : A.1,a
 Test channel : Low / Middle / High
 Ambient temperature : 25 °C
 Relative humidity : 56 %
 Atmospheric pressure : 101 kPa

Table 11: Test Result of 20dB Bandwidth

Test Mode	Channel Frequency (MHz)	20dB Bandwidth (kHz)	2/3 of 20dB Bandwidth (kHz)	Limit (MHz)
BDR	2402	1040.0	693.333	/
	2441	1039.0	692.667	
	2480	1039.0	692.667	
EDR	2402	1302.0	868.000	/
	2441	1304.0	869.333	
	2480	1311.0	874.000	
Maximum Measured Value		1311.00	874.000	/

For the measurement records, refer to the appendix A.

5.1.9 Carrier Frequency Separation

RESULT:
Pass
Test Specification

Test standard : FCC Part 15.247(a)(1)
 : RSS-247 Clause 5.1(2)
 Basic standard : ANSI C63.10: 2013
 Limits : $\geq 25\text{kHz}$ or 2/3 of 20dB bandwidth, whichever is greater
 Kind of test site : Shielded Room

Test Setup

Date of testing : 03.05.2016
 Input voltage : DC 5.0V via USB port for charging
 Operation mode : B
 Test channel : Low / Middle / High
 Ambient temperature : 25 °C
 Relative humidity : 56 %
 Atmospheric pressure : 101 kPa

Table 12: Test Result of Carrier Frequency Separation

Channel	Channel Frequency (MHz)	Measured Channel Separation (KHz)	Limit (kHz)	Result
Low Channel	2402	1000.0	$\geq 25\text{kHz}$ or 2/3 of 20dB bandwidth	Pass
Adjacency Channel	2403			
Middle Channel	2441	1000.0		Pass
Adjacency Channel	2442			
High Channel	2480	1000.0		Pass
Adjacency Channel	2479			

Note:

The limit is maximum 2/3 of the 20 dB bandwidth: 874.000 KHz.

For the measurement records, refer to the appendix A.

5.1.10 Number of Hopping Frequency**RESULT:****Pass****Test Specification**

Test standard : FCC part 15.247(a)(1)(iii)
RSS-247 Clause 5.1(4)
Basic standard : ANSI C63.10: 2013
Limits : ≥ 15 non-overlapping channels
Kind of test site : Shielded Room

Test Setup

Date of testing : 03.05.2016
Input voltage : DC 3.7V via internal rechargeable lithium battery
Operation mode : B
Ambient temperature : 25 °C
Relative humidity : 56 %
Atmospheric pressure : 101 kPa

Table 13: Test Result of Number of Hopping Frequency

Frequency Range	Measured Quantity of Hopping Channel	Limit	Result
2402 to 2480 MHz	79	≥ 15	Pass

For the measurement records, refer to the appendix A.

5.1.11 Time of Occupancy**RESULT:****Pass****Test Specification**

Test standard : FCC part 15.247(a)(1)(iii)
RSS-247 Clause 5.1(4)
Basic standard : ANSI C63.10: 2013
Limits : < 0.4s
Kind of test site : Shielded Room

Test Setup

Date of testing : 03.05.2016
Input voltage : DC 5.0V via USB port for charging
Operation mode : B
Test channel : Low / Middle / High
Ambient temperature : 25 °C
Relative humidity : 56 %
Atmospheric pressure : 101 kPa

Table 14: Test Result of Time of Occupancy

Test Mode	Test Channel	Data Packet	Pulse width (ms)	Measured Dwell time(s)	Limit (s)
BDR mode	2402	DH1	0.368	0.118	< 0.4s
		DH3	1.624	0.260	
		DH5	2.870	0.306	
	2441	DH1	0.360	0.115	
		DH3	1.617	0.259	
		DH5	2.870	0.306	
	2480	DH1	0.368	0.118	
		DH3	1.624	0.260	
		DH5	2.870	0.306	
EDR mode	2402	3DH1	0.384	0.123	
		3DH3	1.638	0.262	
		3DH5	2.880	0.307	
	2441	3DH1	0.384	0.123	
		3DH3	1.638	0.262	
		3DH5	2.880	0.307	
	2480	3DH1	0.384	0.123	
		3DH3	1.638	0.262	
		3DH5	2.880	0.307	
Maximum Measured Value			2.880	0.307	

Note:

Dwell time = Pulse width x (Hopping rate / Number of channels) x Period

Period = 0.4 (seconds/ channel) x 79 (channel) = 31.6 seconds

For the measurement records, refer to the appendix A.

5.1.12 Conducted Emission**RESULT:****Pass****Test Specification**

Test standard	: FCC Part 15.207(a) & FCC Part 15.107(a) RSS-Gen Clause 8.8 & ICES-003
Basic standard	: ANSI C63.10: 2013 & ANSI C63.4: 2014
Frequency range	: 0.15 – 30MHz
Limits	: FCC Part 15.207(a) & FCC Part 15.107(a) RSS-Gen Table 3 & ICES-003 Table 2
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 28.04.2016 & 16.05.2016
Input voltage	: DC 5.0V via USB port for charging
Operation mode	: C, D, E
Earthing	: Not connected
Ambient temperature	: 25 °C
Relative humidity	: 56 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix B.

5.1.13 Radiated Emission

RESULT:**Pass****Test Specification**

Test standard	: FCC Part 15.109(a) ICES-003
Basic standard	: ANSI C63.4: 2014
Frequency range	: 30 - 6000MHz
Classification	: Class B
Limits	: FCC Part 15.109(a) ICES-003 Table 5 & Table 7
Kind of test site	: 3m Semi-anechoic Chamber

Test Setup

Date of testing	: 28.04.2016 & 16.05.2016
Input voltage	: DC 3.7V via internal rechargeable lithium battery
Operation mode	: D,E
Earthing	: Not connected
Ambient temperature	: 24 °C
Relative humidity	: 53 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix B.

6 Safety Human Exposure

6.1 Radio Frequency Exposure Compliance

6.1.1 Electromagnetic Fields

RESULT:**Pass****Test Specification**

Test standard : FCC KDB Publication 447498 v06
RSS-102 Issue 5 March 2015

Measurement Record:

The minimum distance for the EUT is less than 5mm.

Since maximum peak output power of the transmitter is 4.81 dBm \approx 3.03 mW $<$ 10 mW.

Hence the EUT is excluded from SAR evaluation according to FCC KDB Publication 447498 D01 General RF Exposure Guidance v06.

The maximum peak output power of the transmitter is 4.81 dBm (3.03 mW), which is far below the SAR exclusion threshold level 4 mW \approx 6.02 dBm.

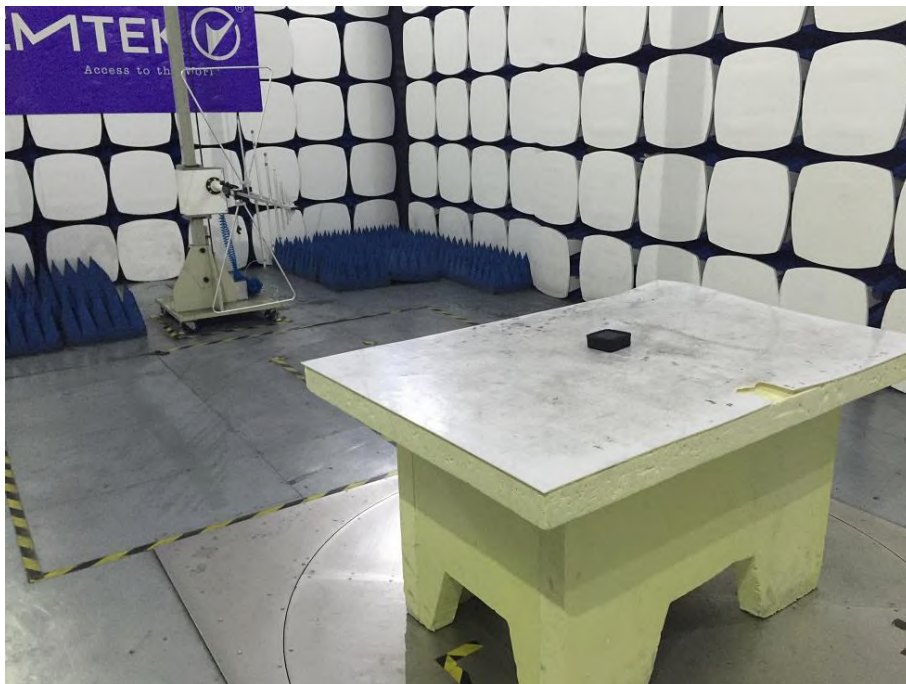
Hence the EUT is exempted from routine evaluation limits (SAR Evaluation) according to clause 2.5.1 of RSS-102 Issue 5.

7 Photographs of the Test Set-Up

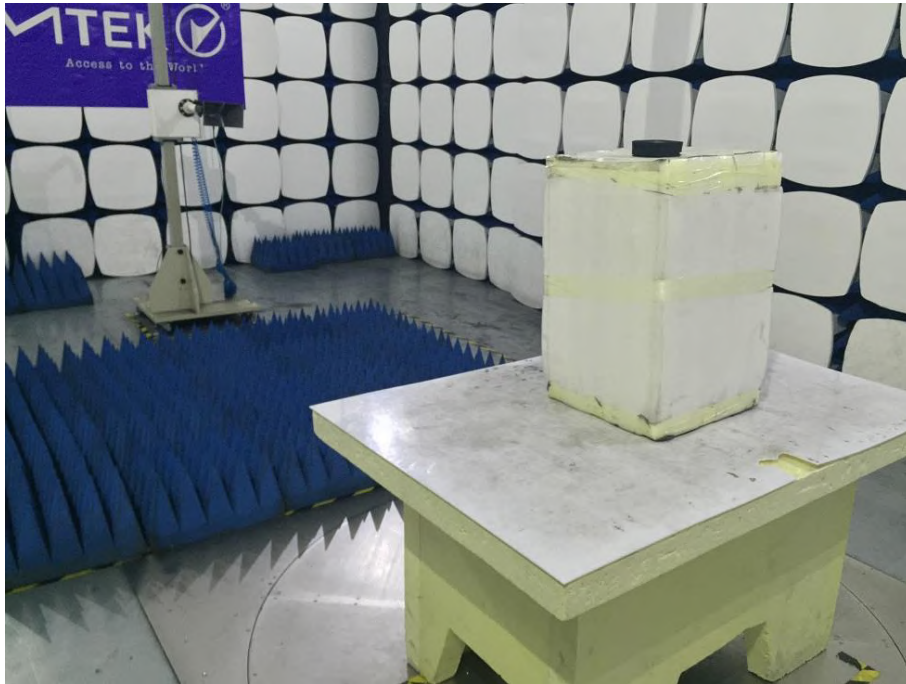
Photograph 1: Set-up for Radiated Spurious Emission (9kHz ~ 30MHz)



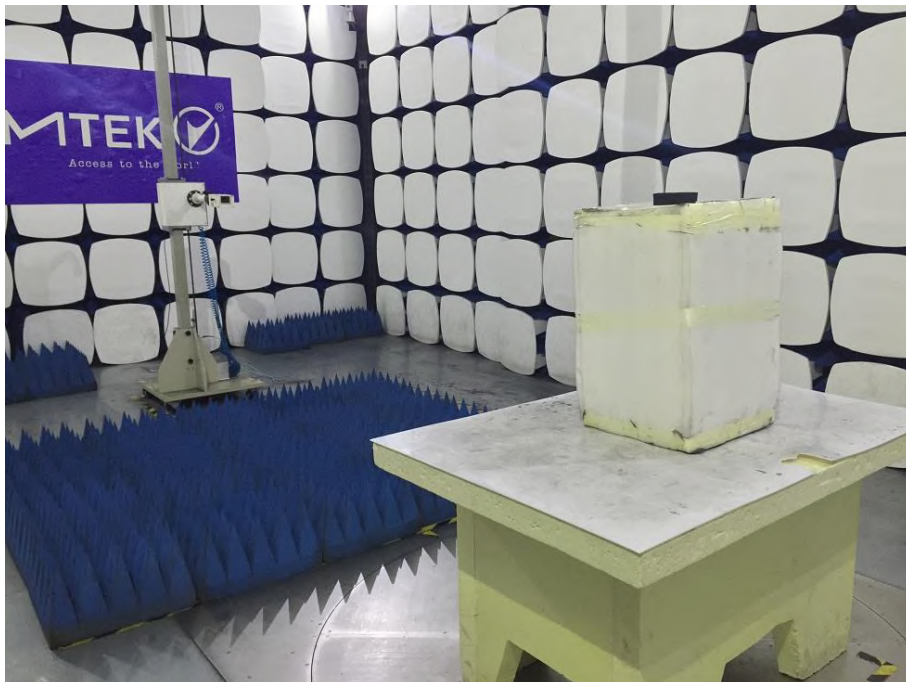
Photograph 2: Set-up for Radiated Spurious Emission (30MHz~1GHz)



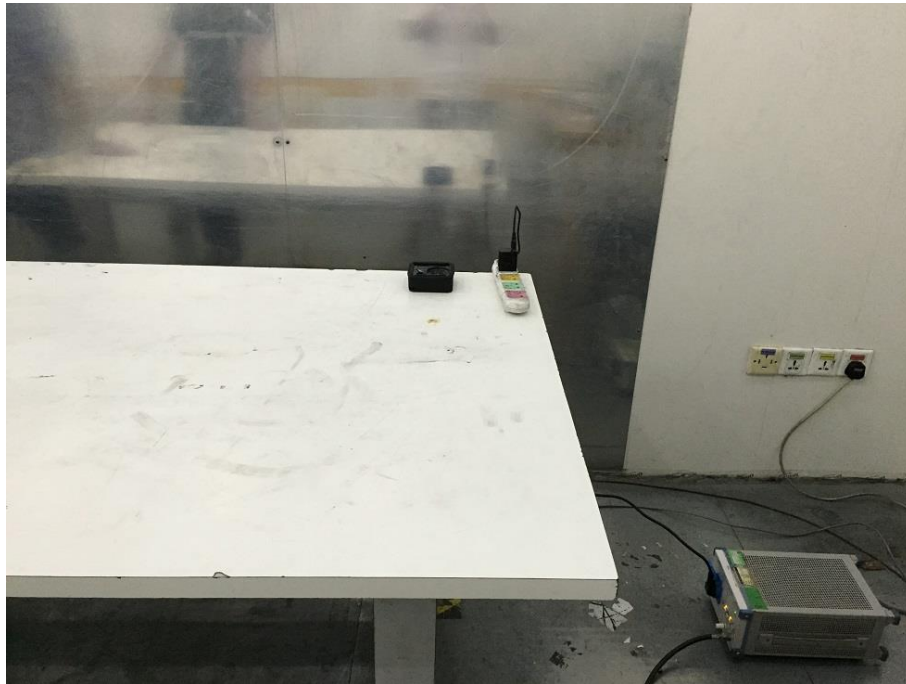
Photograph 3: Set-up for Radiated Spurious Emission (1GHz ~ 18GHz)



Photograph 4: Set-up for Radiated Spurious Emission (18GHz ~ 26GHz)



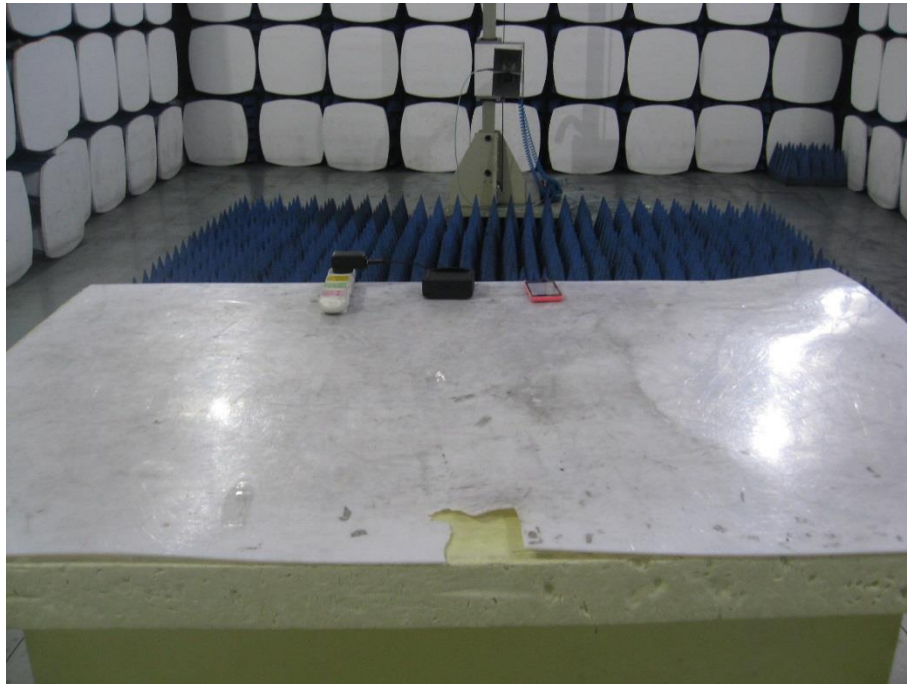
Photograph 5: Set-up for Conducted Emission



Photograph 6: Set-up for Radiated Emission (30MHz ~ 1GHz)



Photograph 7: Set-up for Radiated Emission (1GHz ~ 6GHz)



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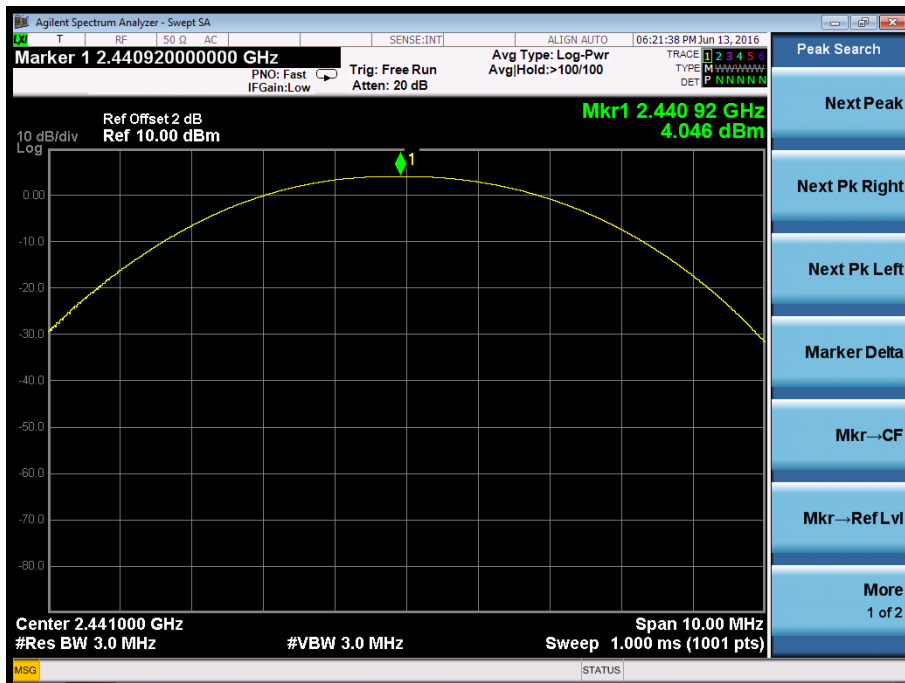
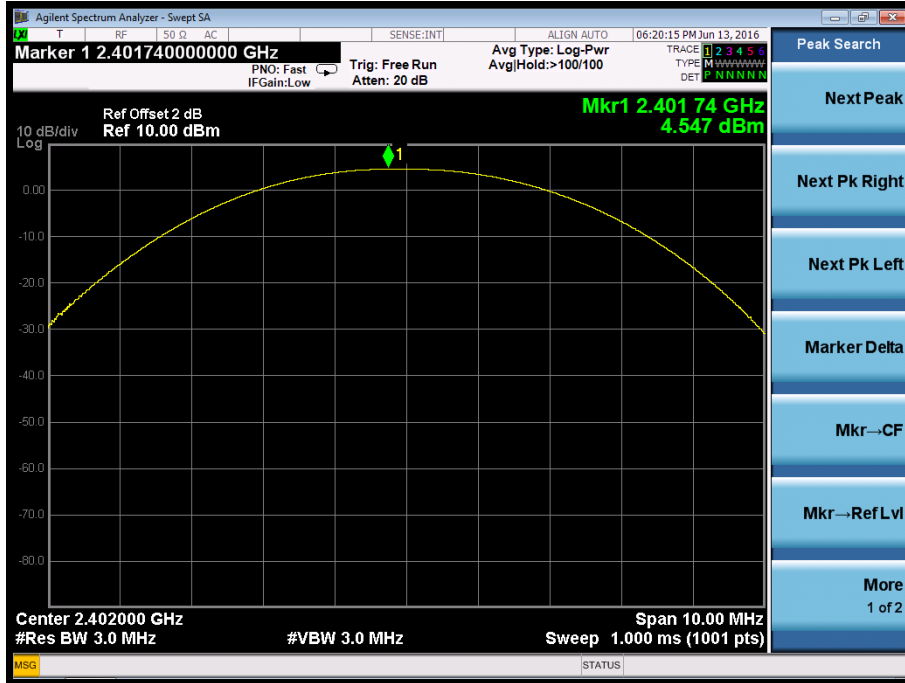
Appendix A

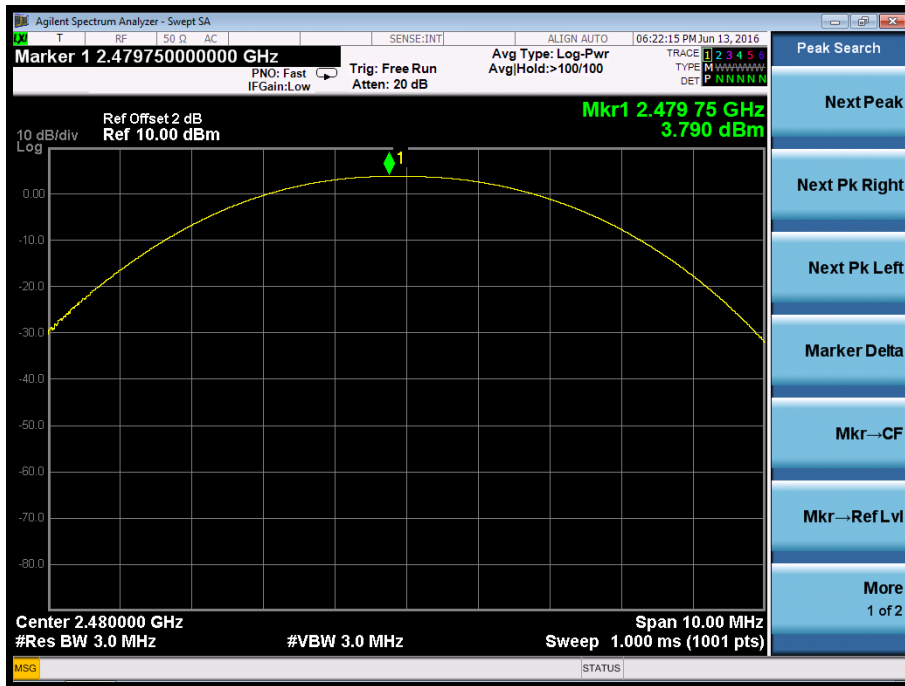
Test Results of Bluetooth 4.1 (Dual mode) of Conducted Testing

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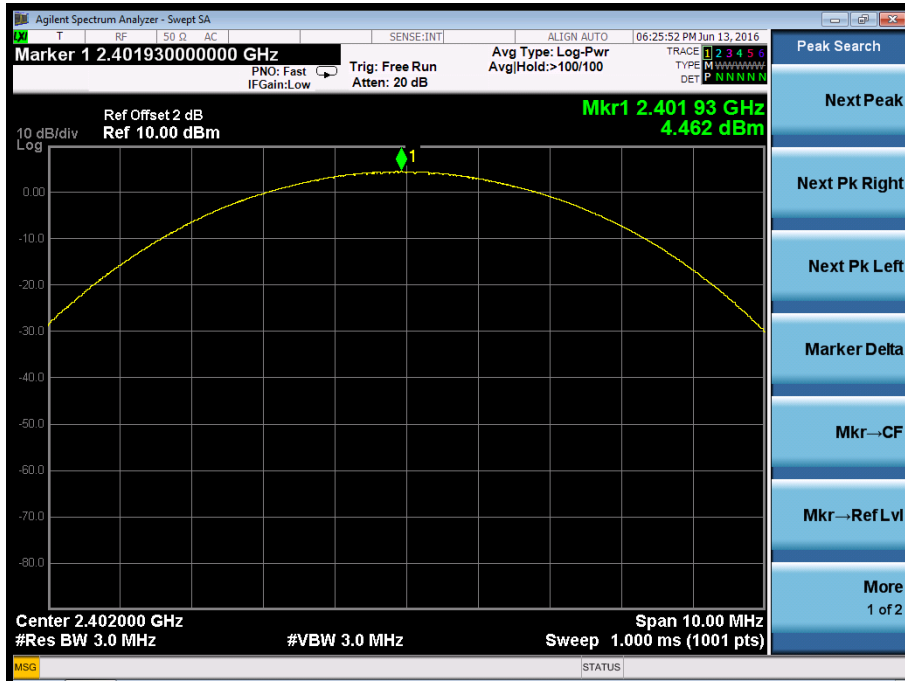
Appendix A.1: Maximum Peak Conducted Output Power

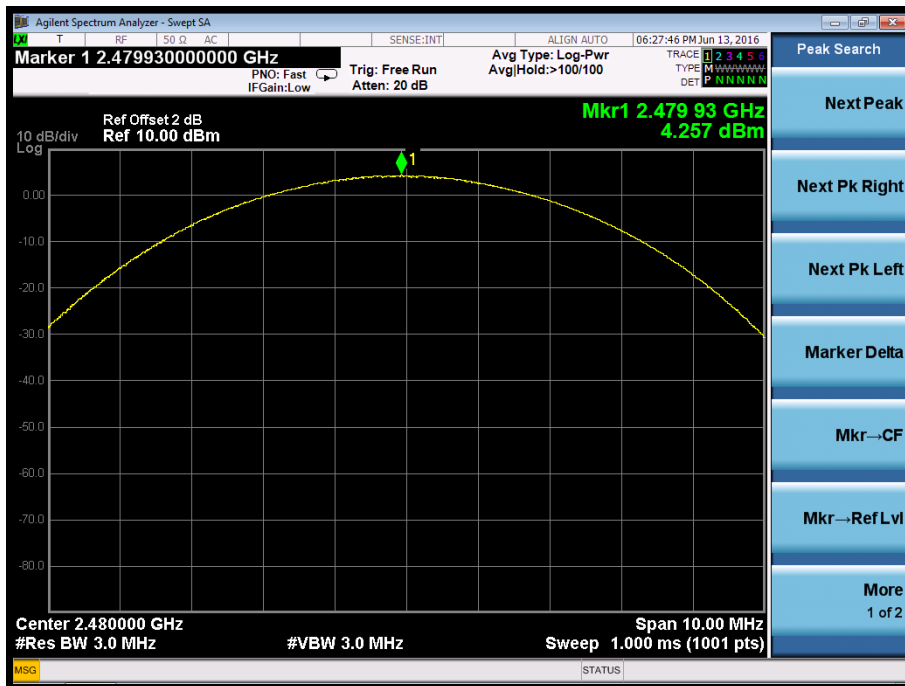
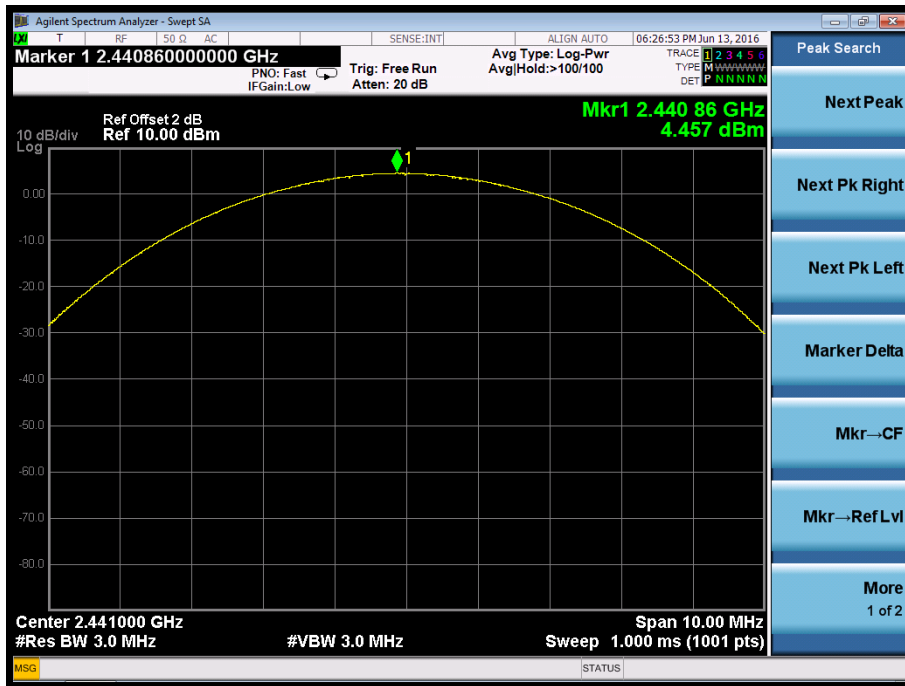
BDR Mode, DH1



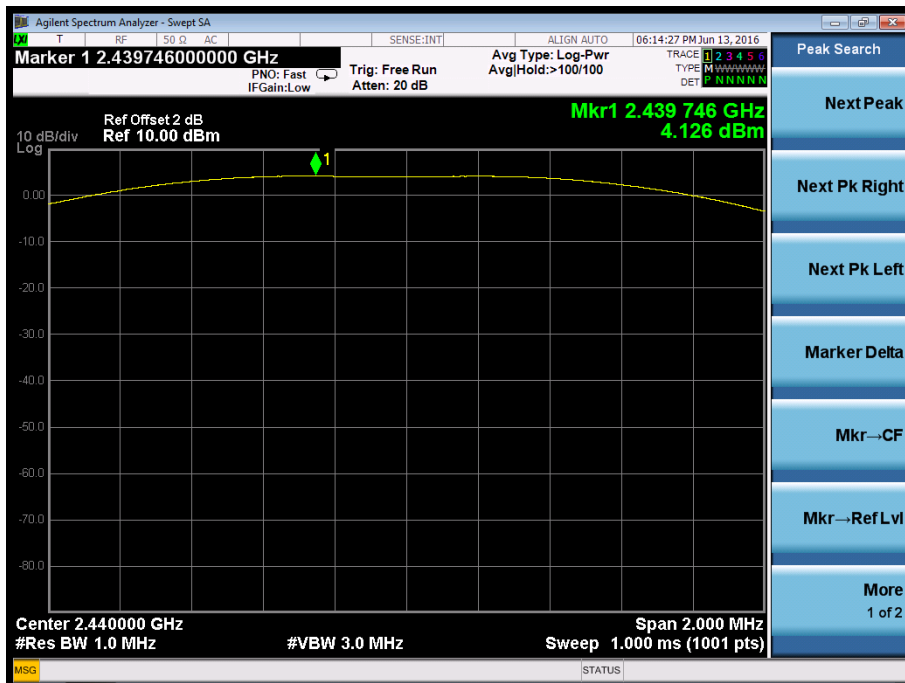
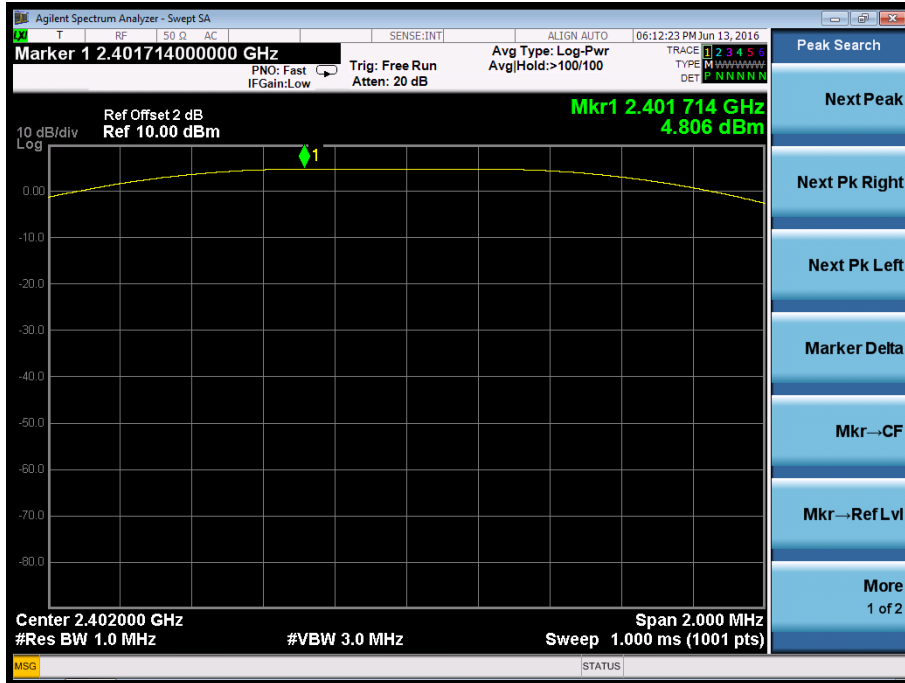


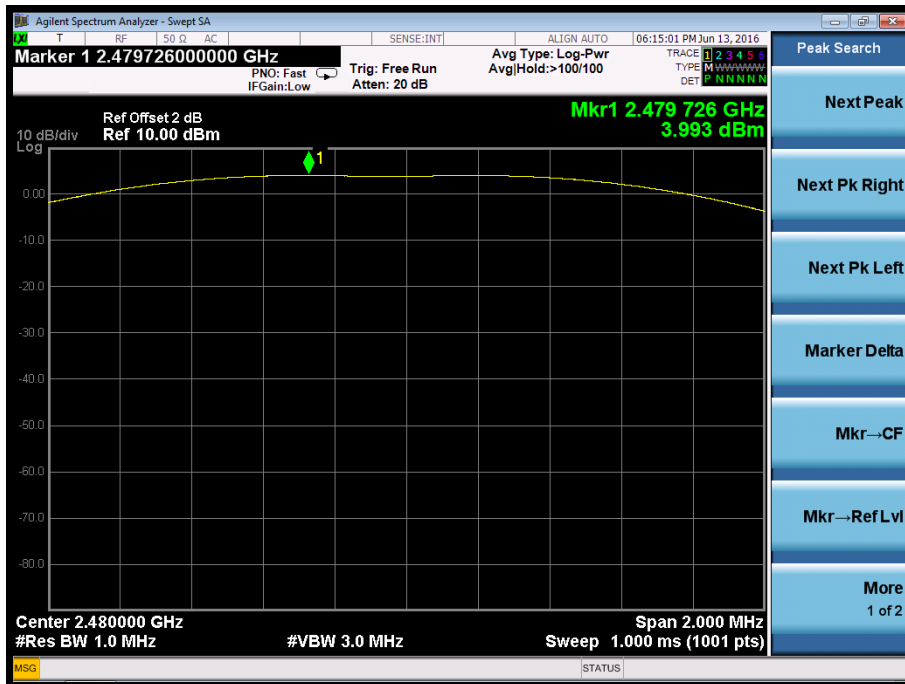
EDR Mode, 3DH1





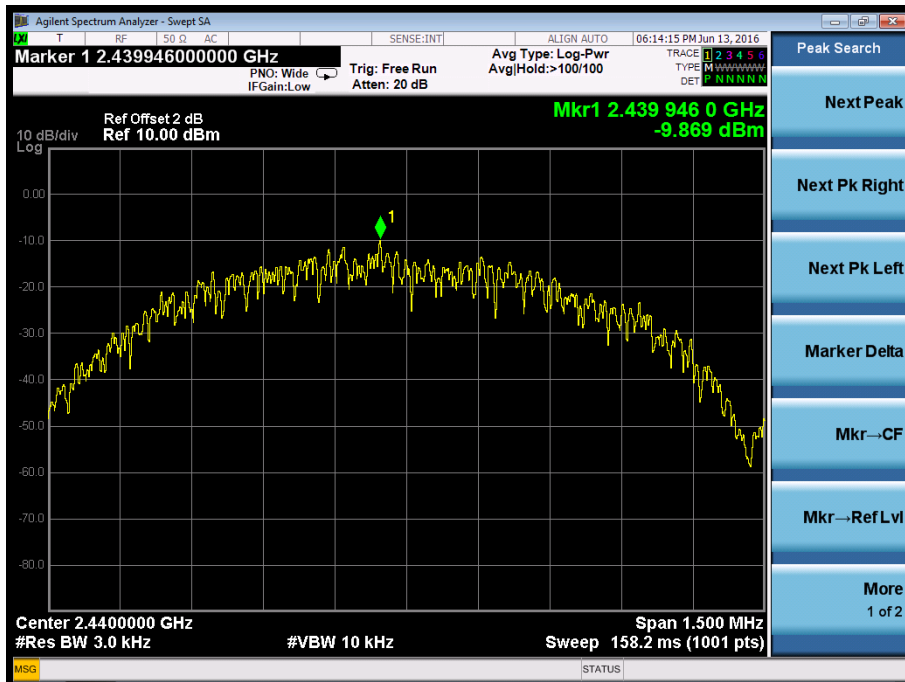
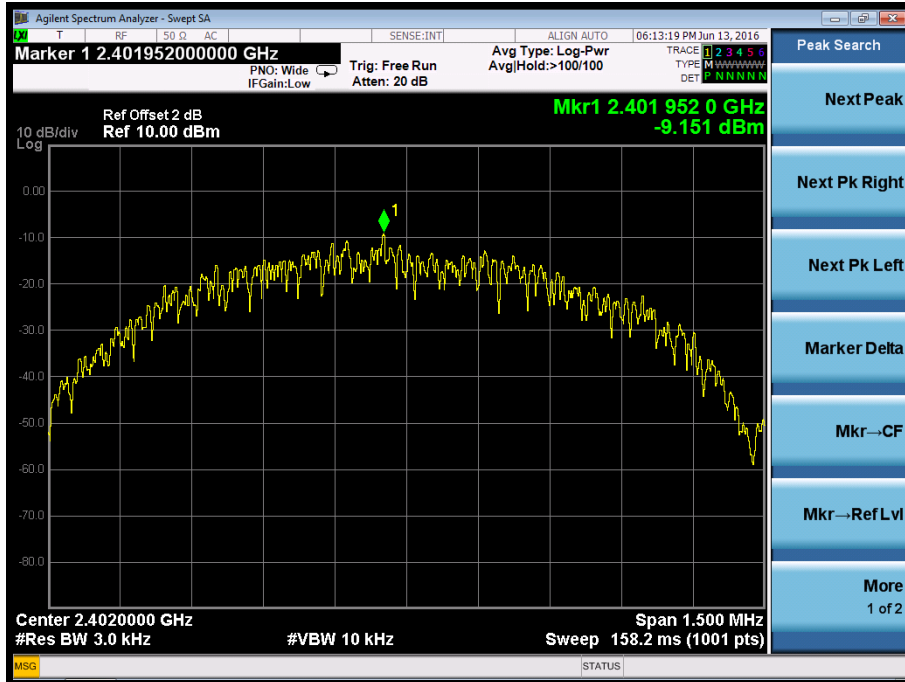
Low Energy Mode

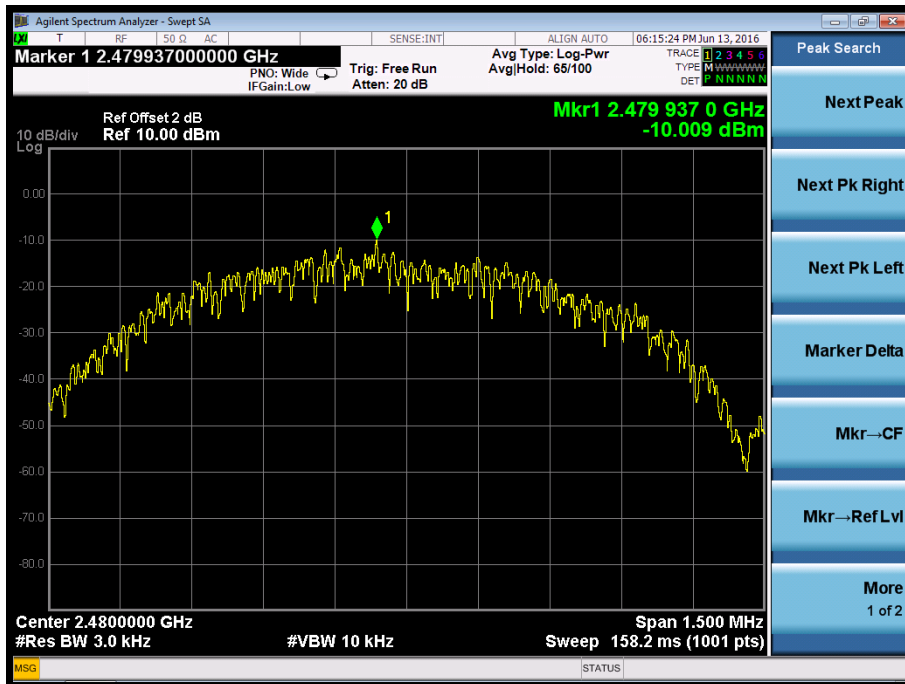




Appendix A.2: Conducted Power Spectral Density

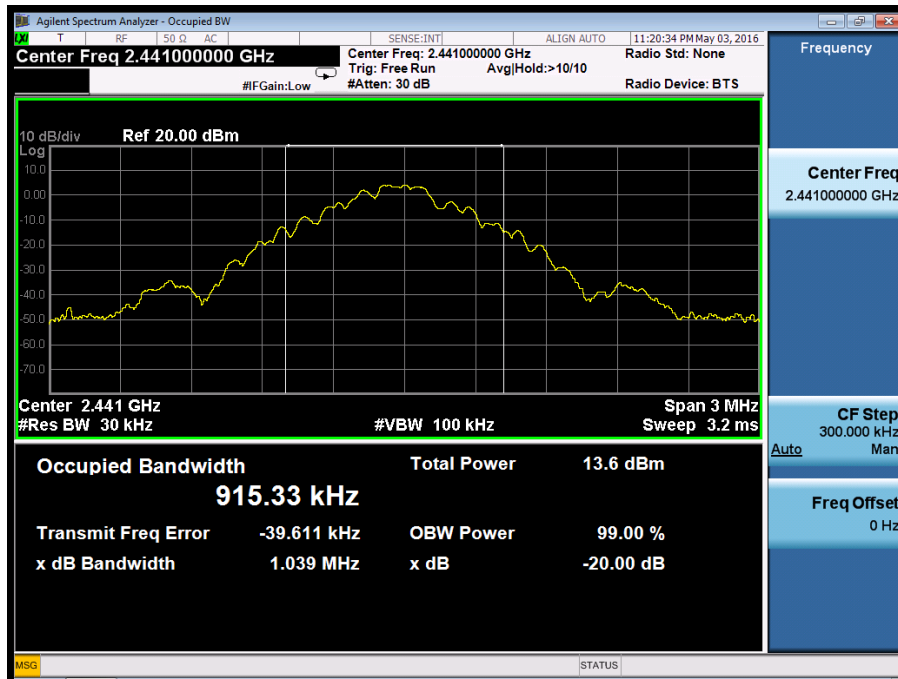
Low Energy Mode

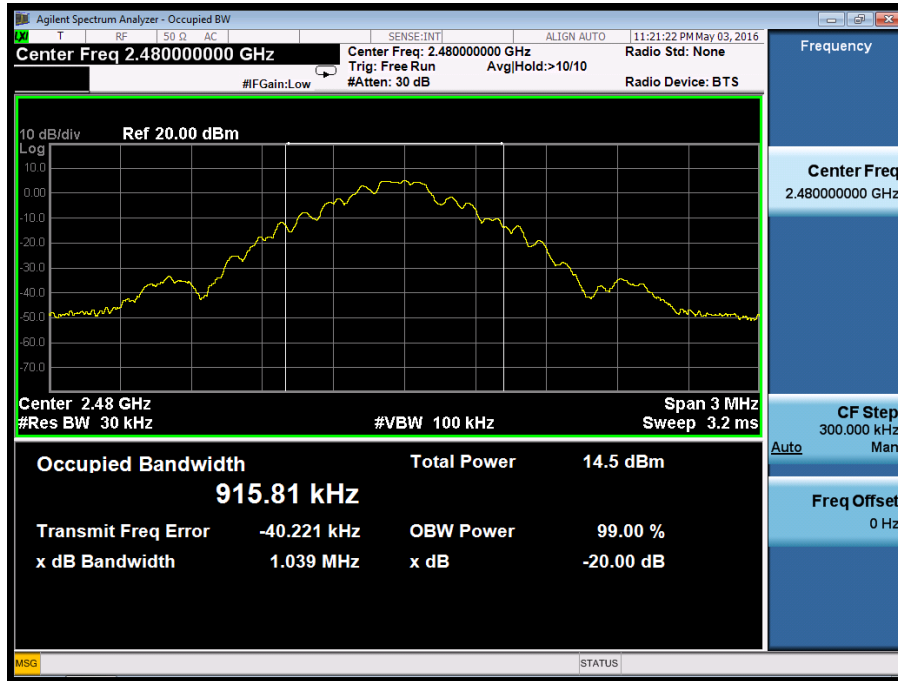




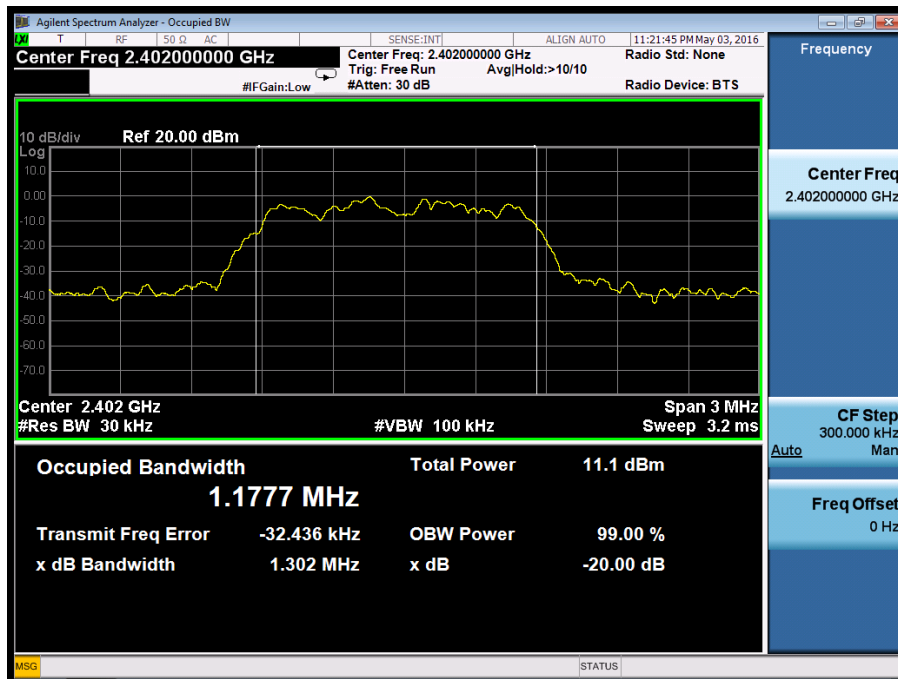
Appendix A.3: 99% Bandwidth & 6dB Bandwidth & 20dB Bandwidth

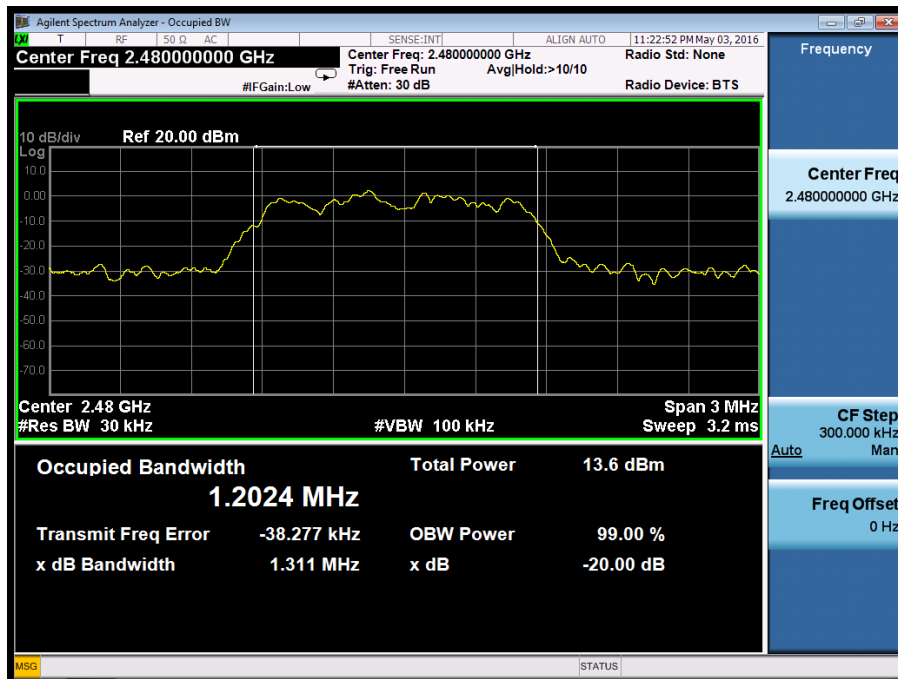
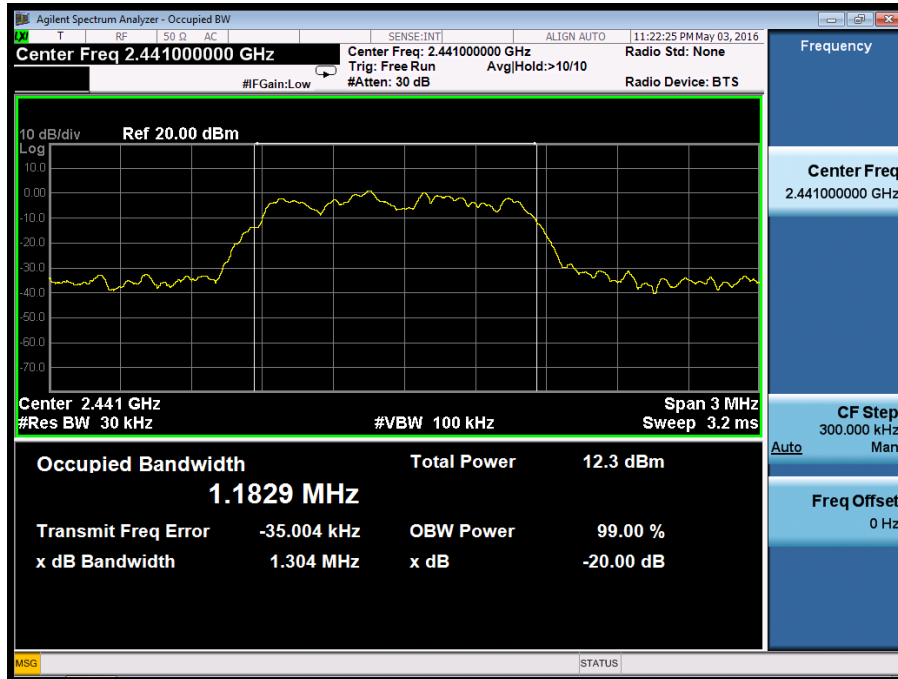
BDR Mode, DH1



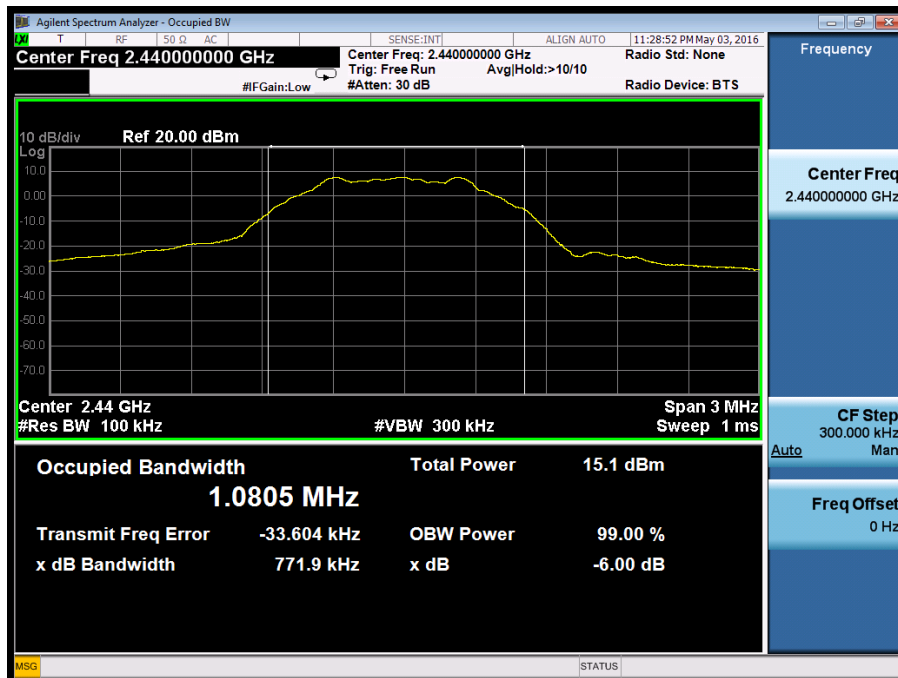
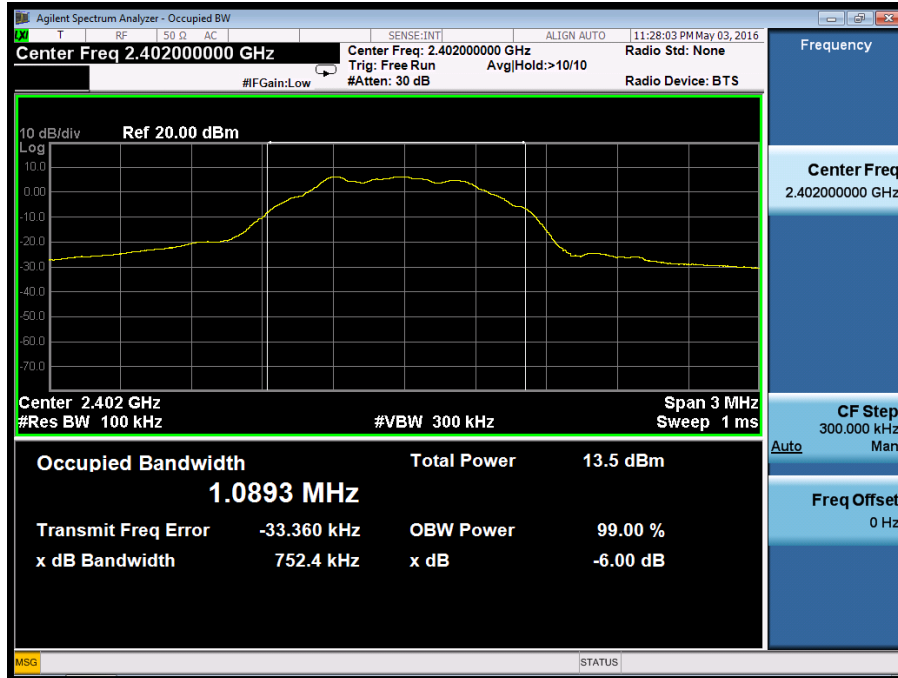


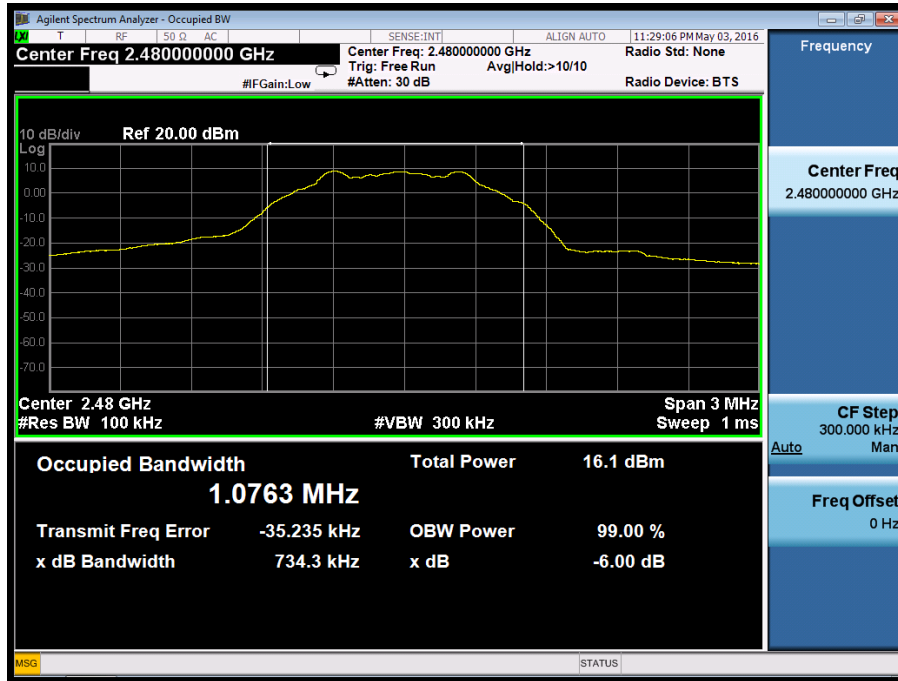
EDR Mode, 3DH1





Low Energy Mode



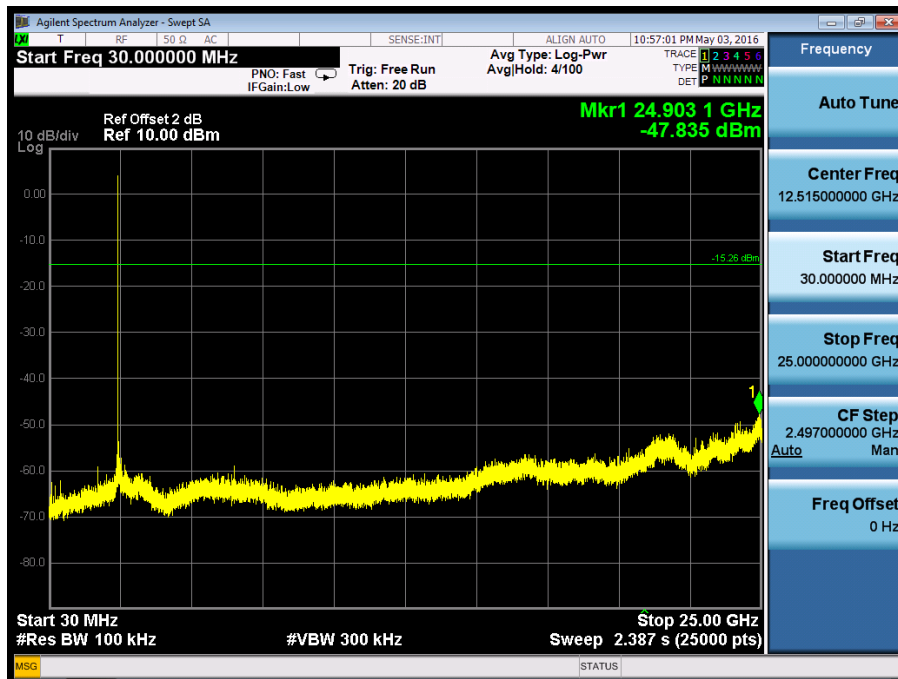


**Appendix A.4: Conducted Spurious Emissions Measured in 100 kHz Bandwidth
BDR Mode, DH1**





EDR Mode, 3DH1





Low Energy Mode

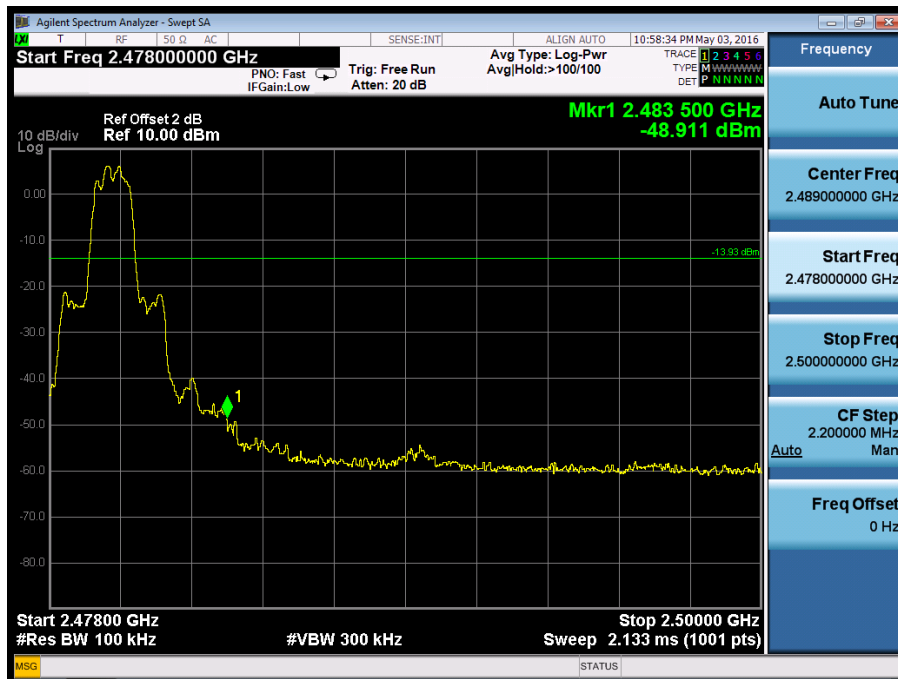
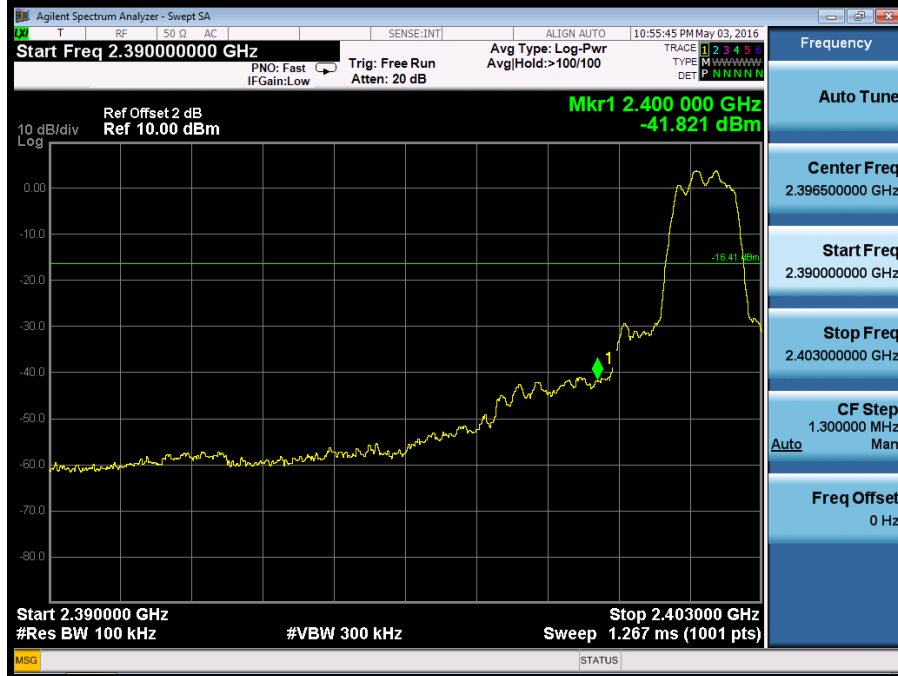




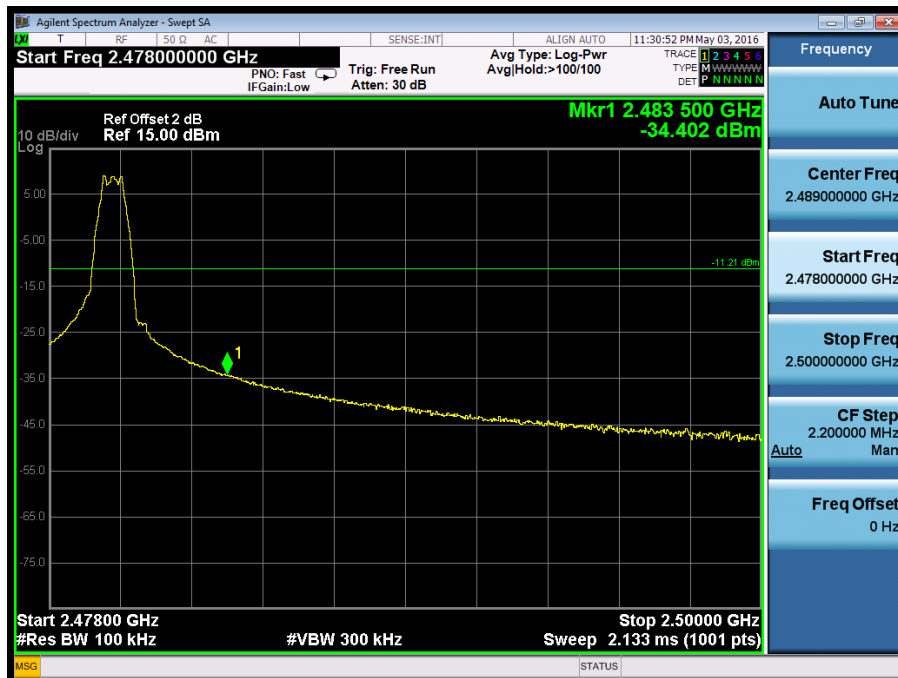
BDR Mode, Band Edge



EDR Mode, Band Edge

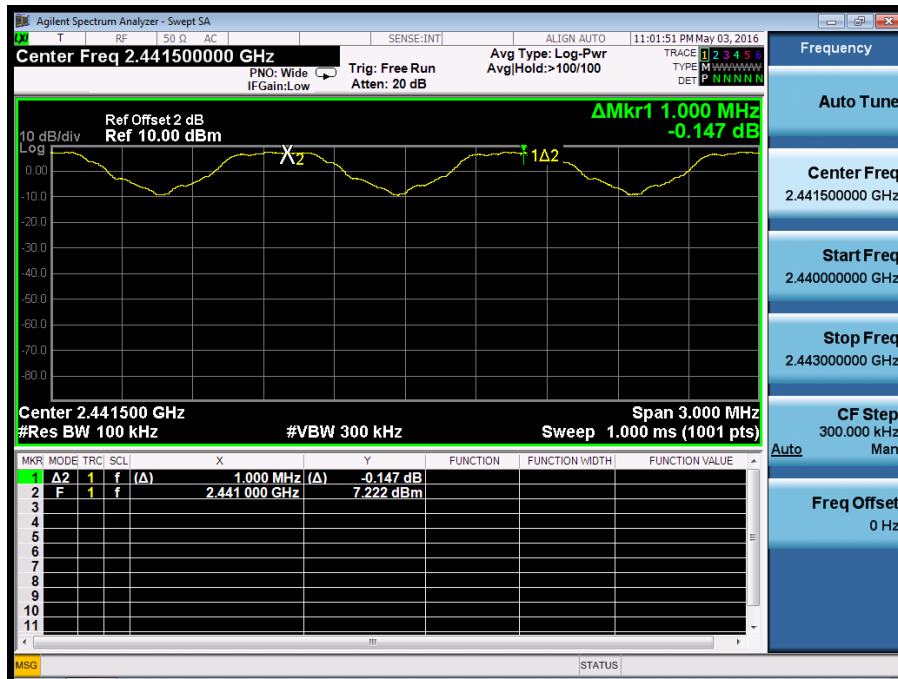
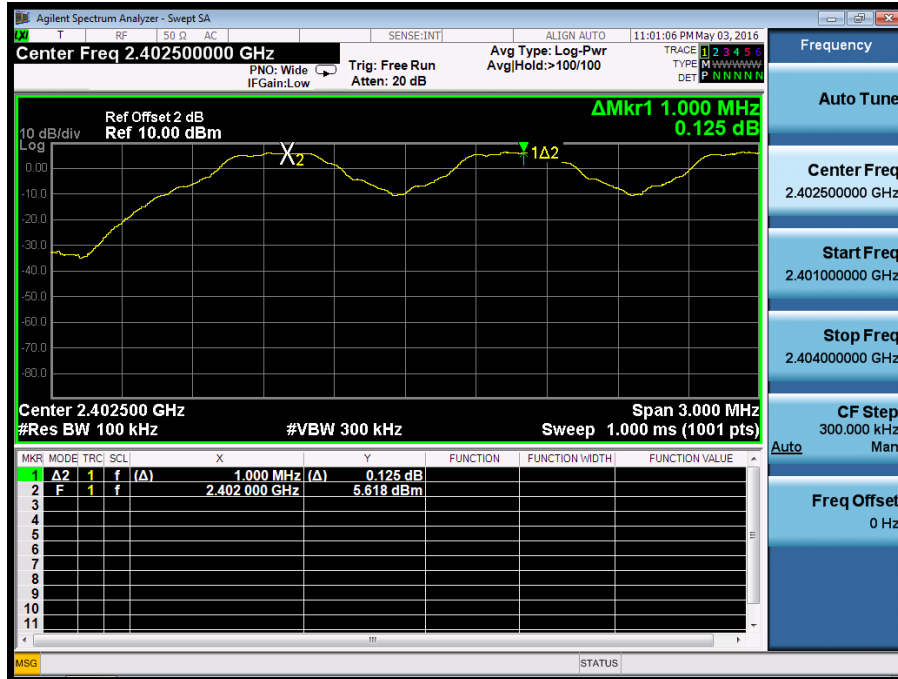


Low Energy Mode, Band Edge



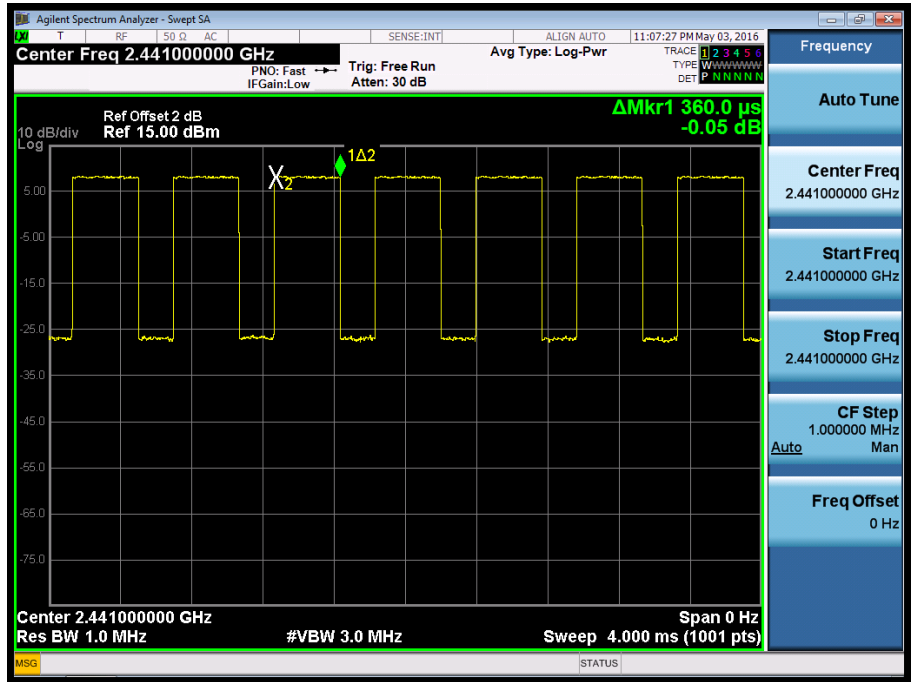
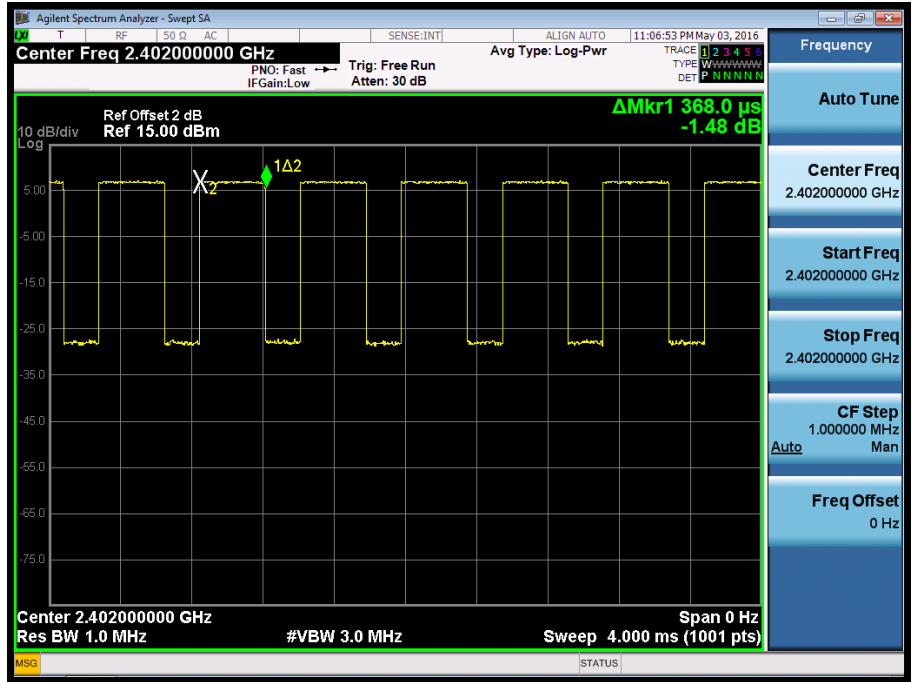
Appendix A.5: Carrier Frequency Separation

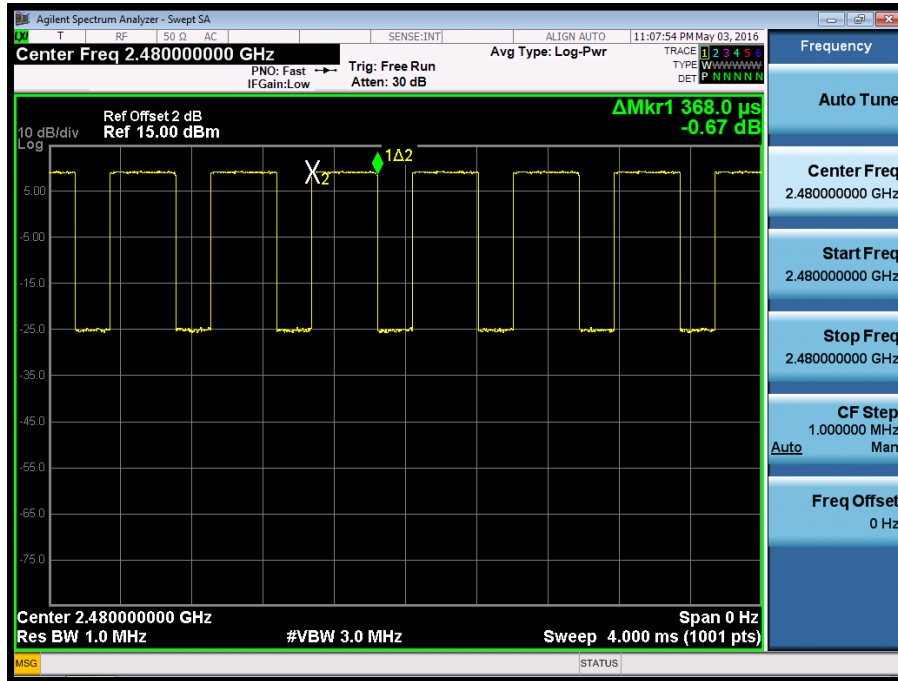
Hopping Mode



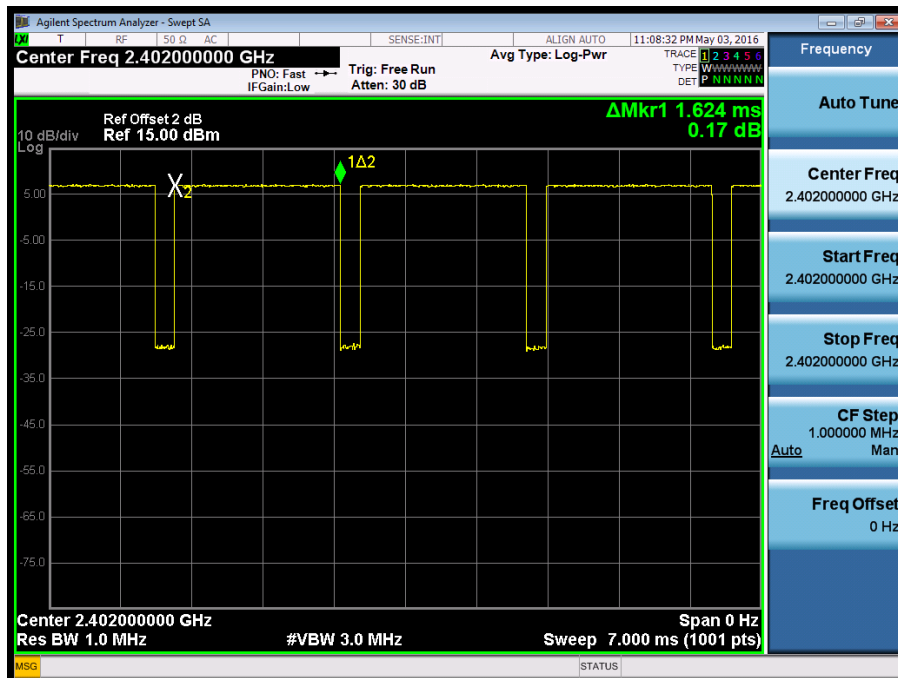
Appendix A.7: Time of Occupancy

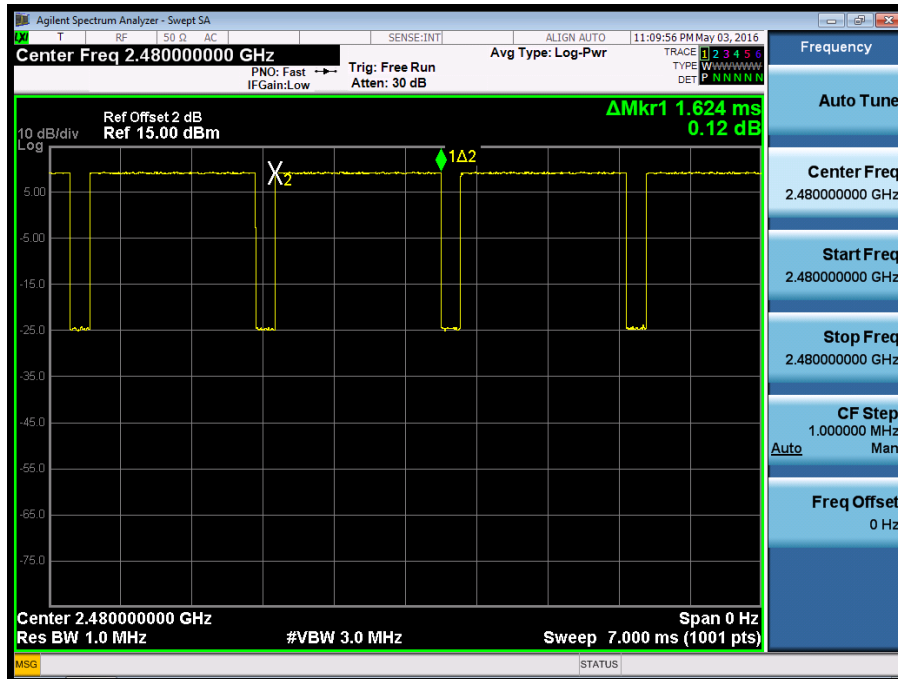
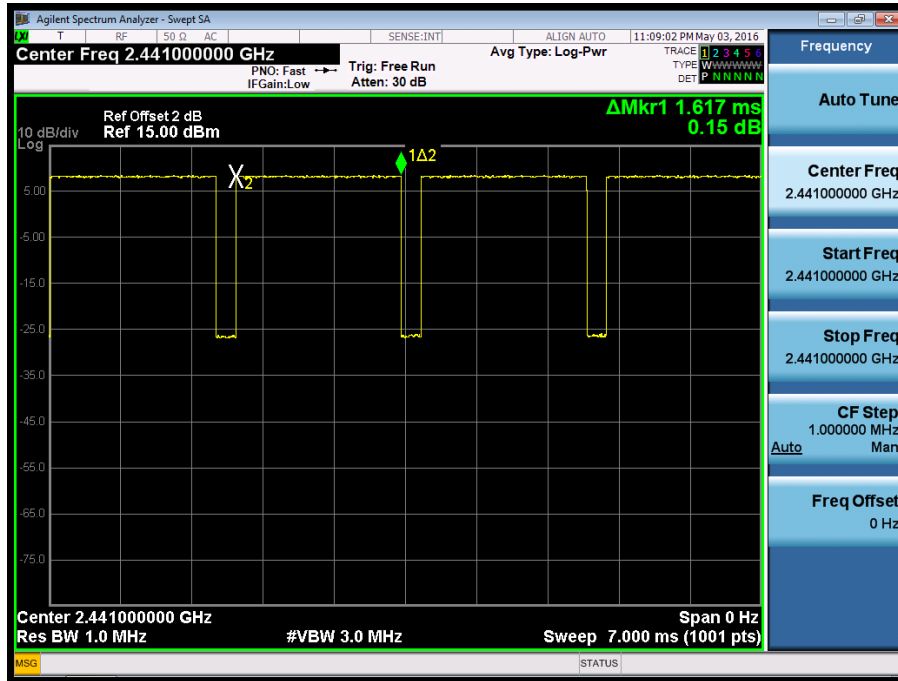
BDR Mode, DH1



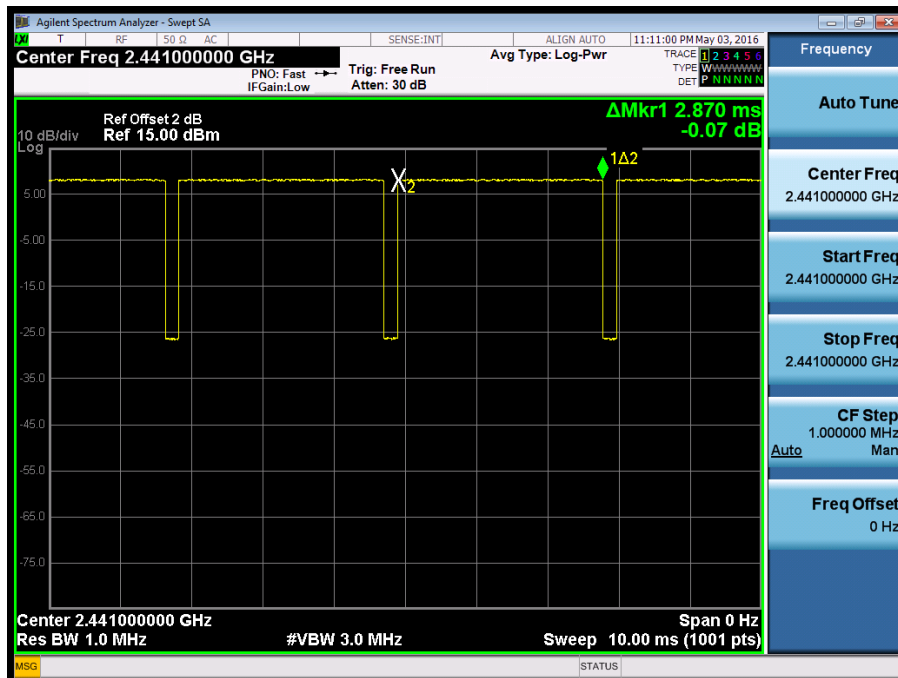


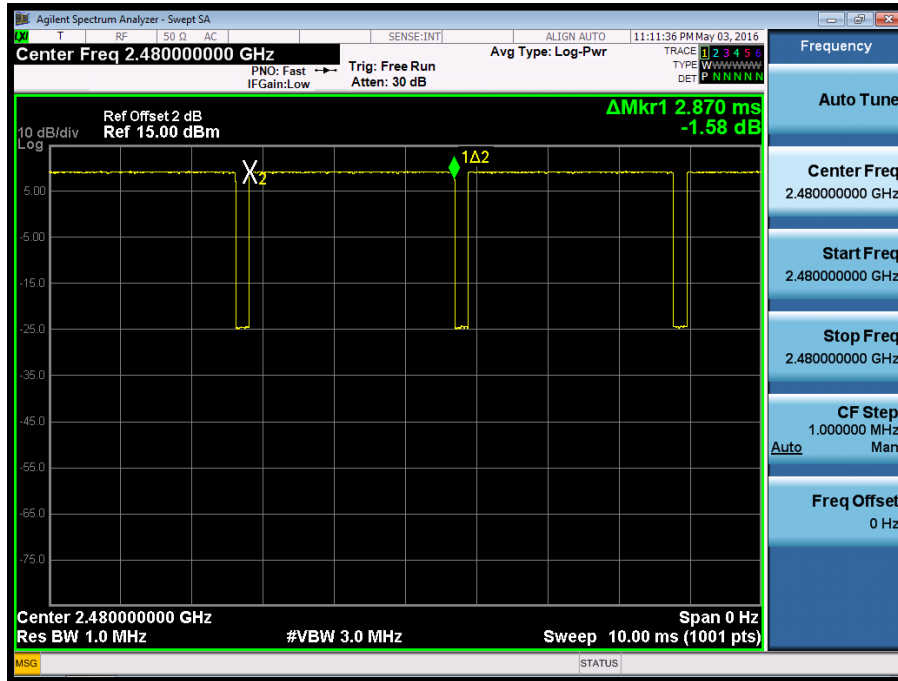
BDR Mode, DH3



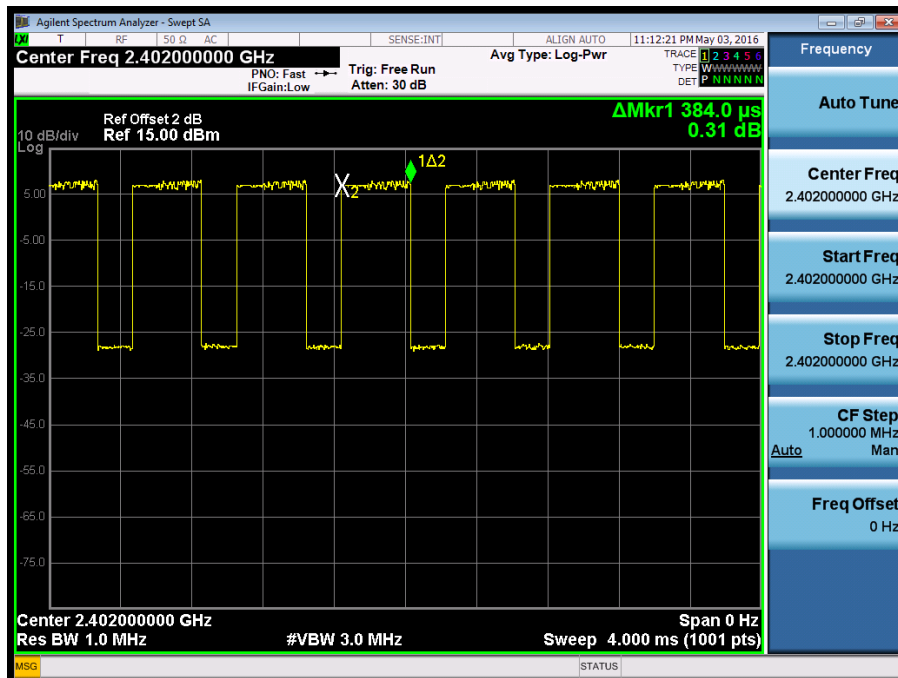


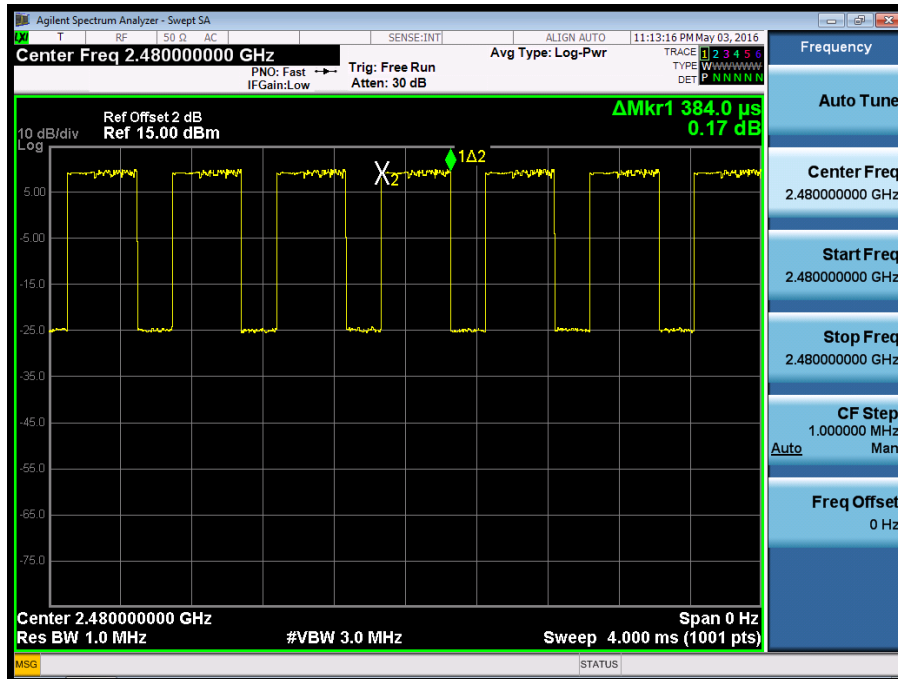
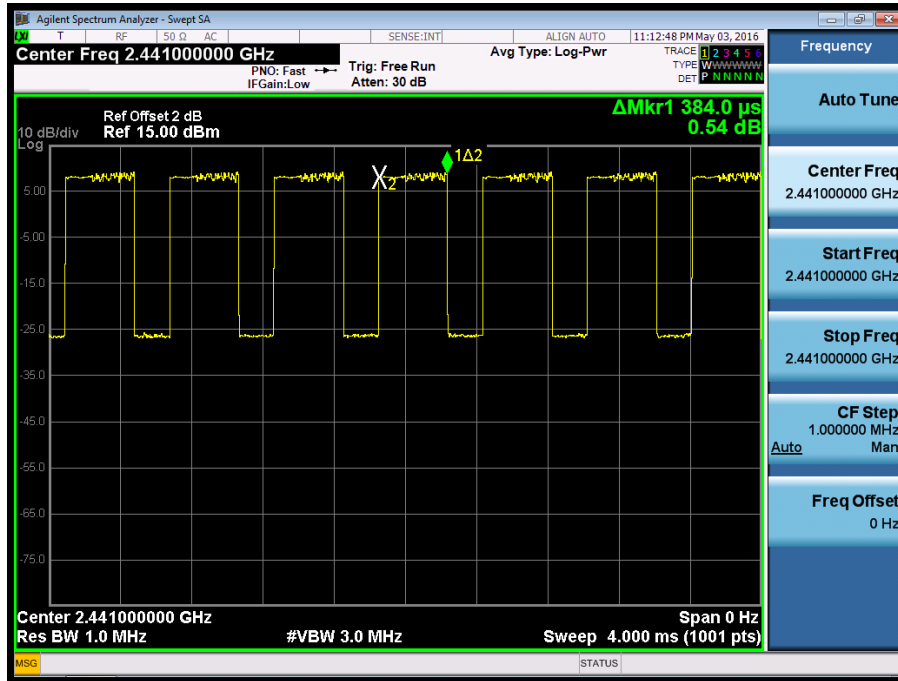
BDR Mode, DH5



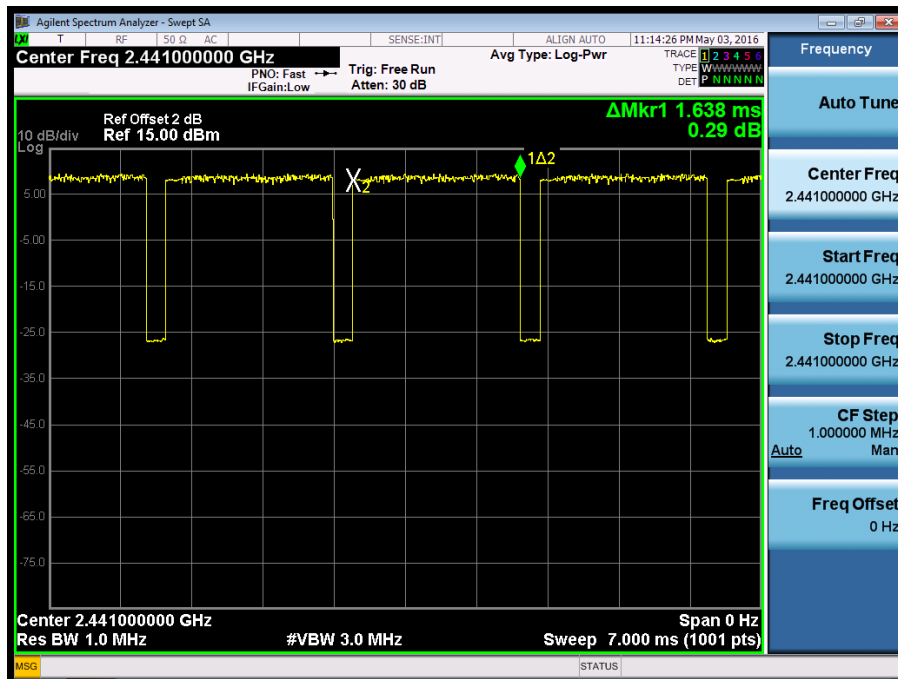
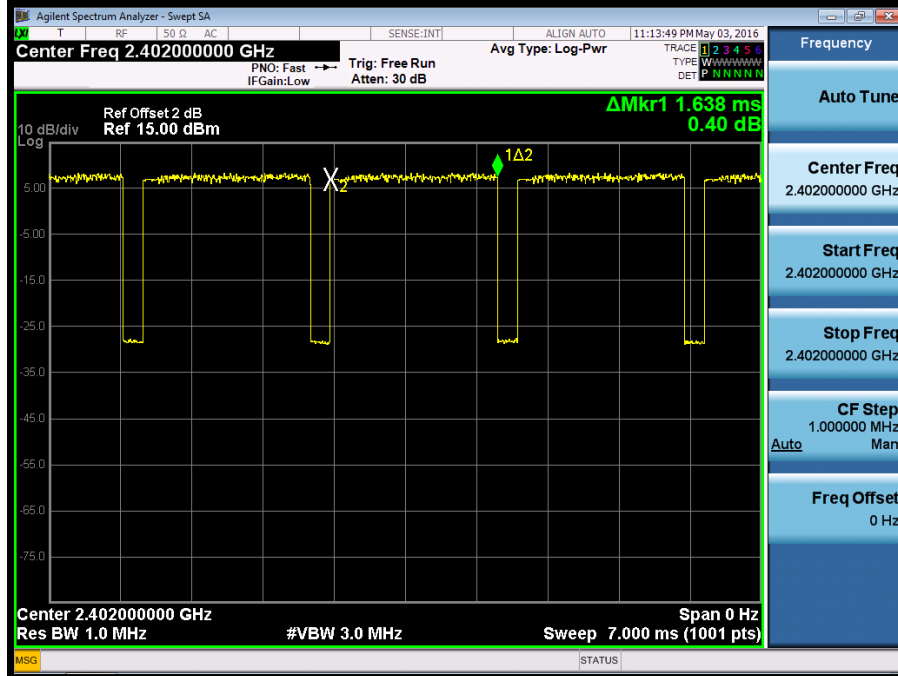


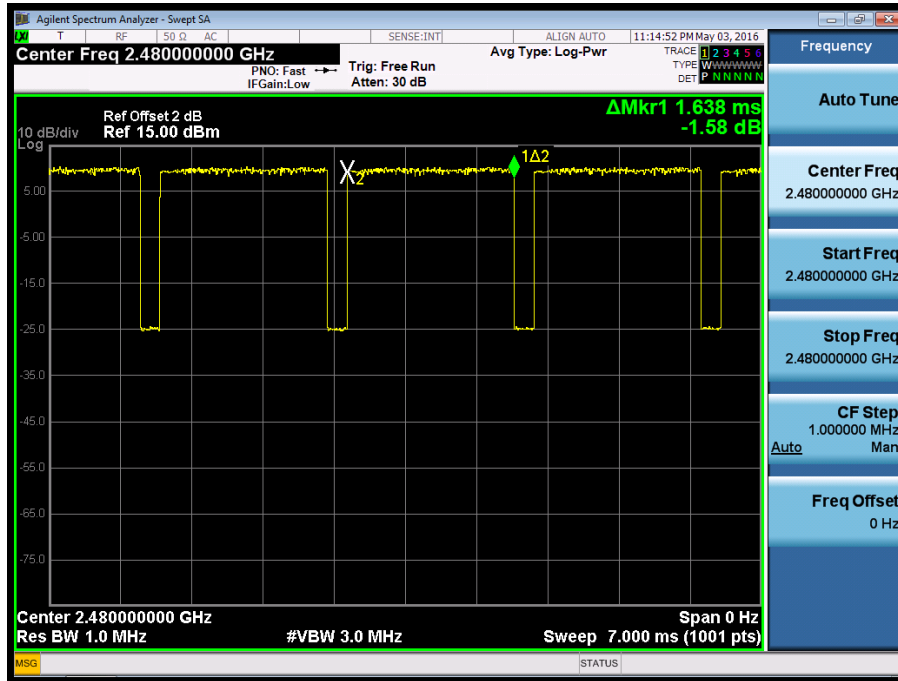
EDR Mode, 3DH1





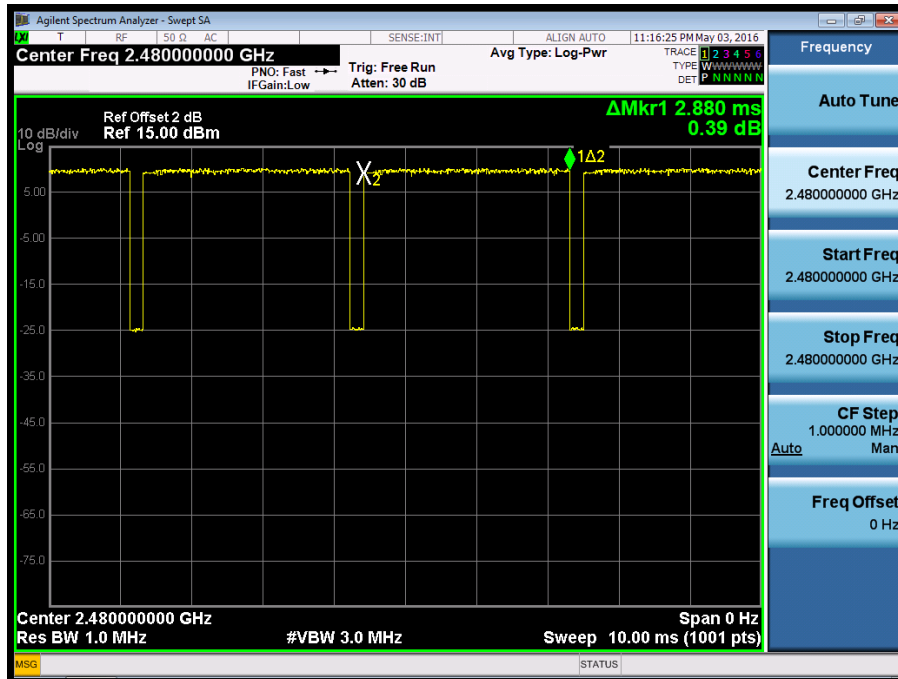
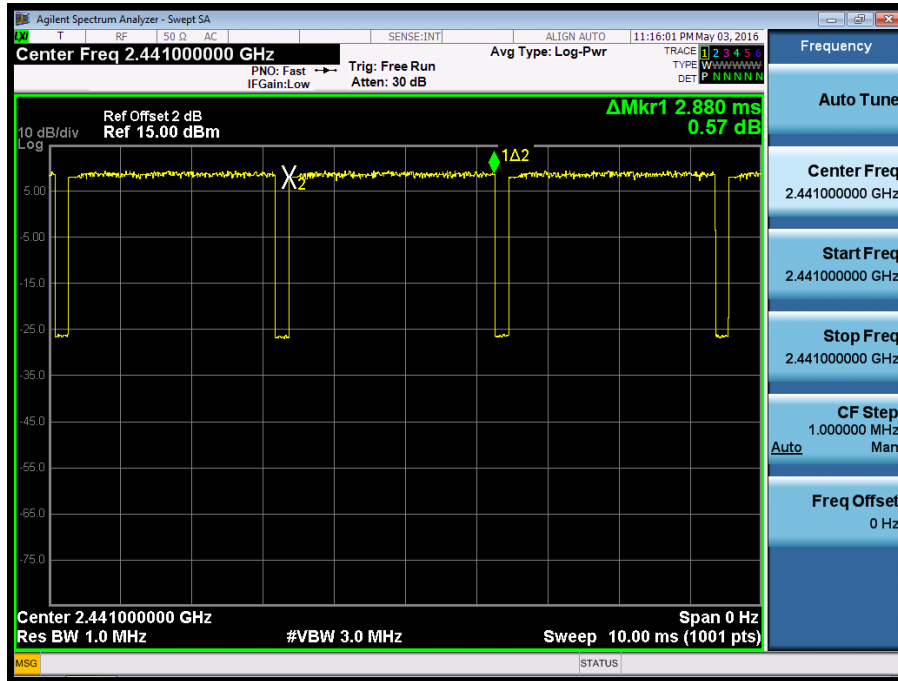
EDR Mode, 3DH3





EDR Mode, 3DH5





Appendix B

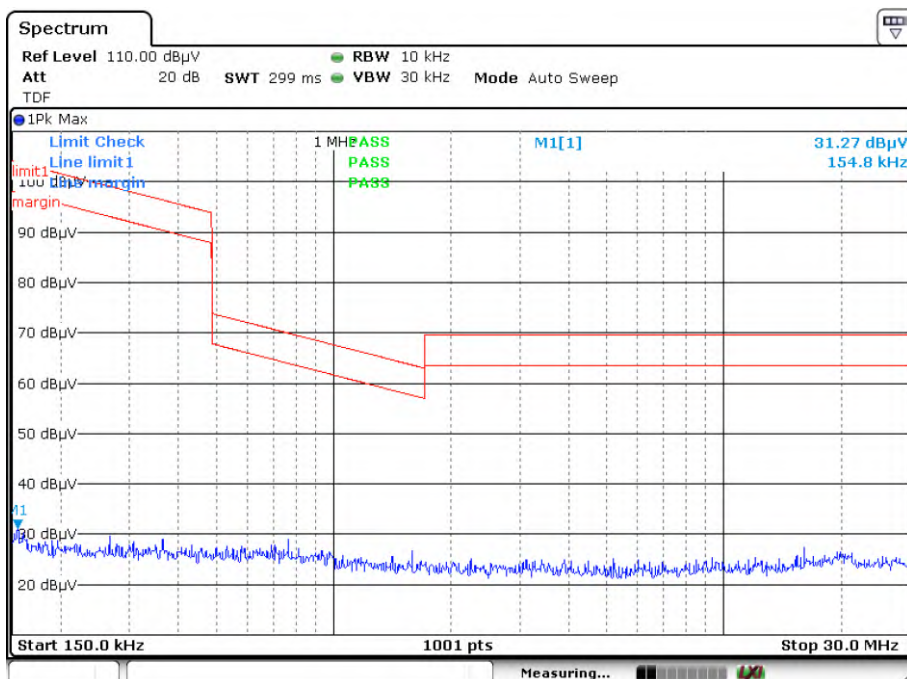
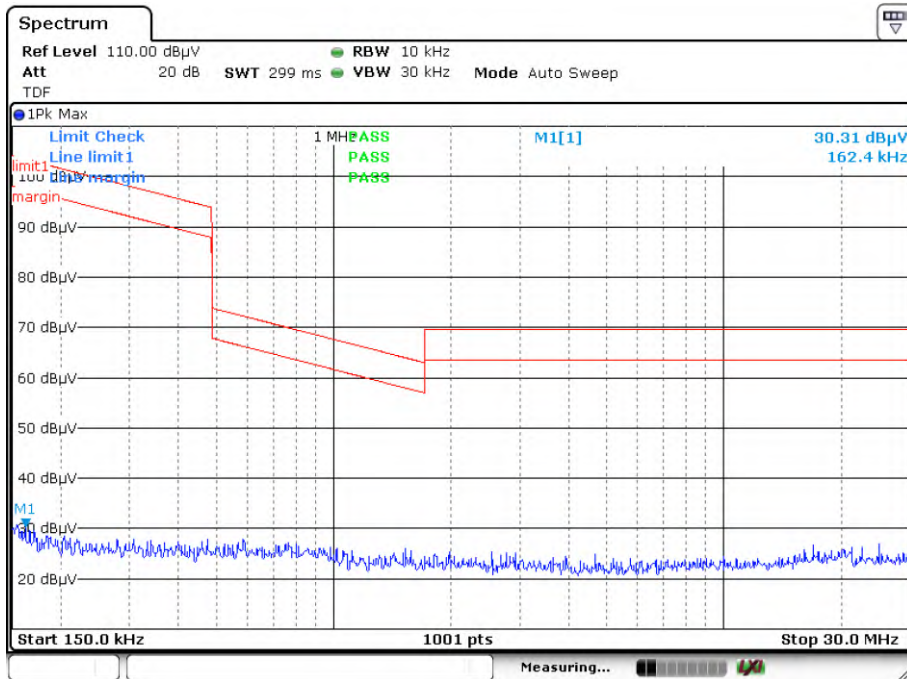
Test Results of Bluetooth 4.1 (Dual mode) of Radiated Testing

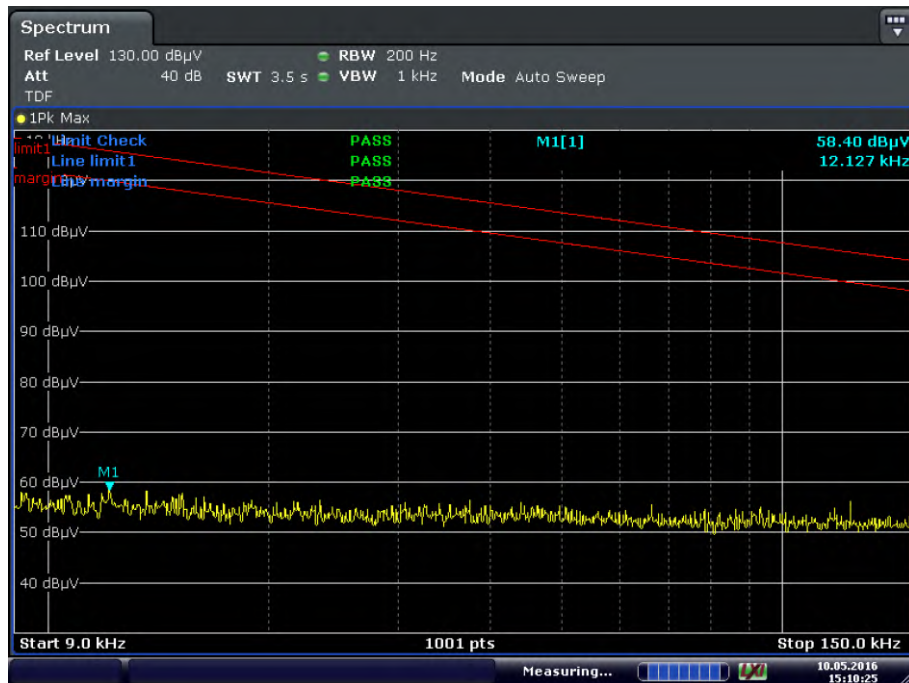
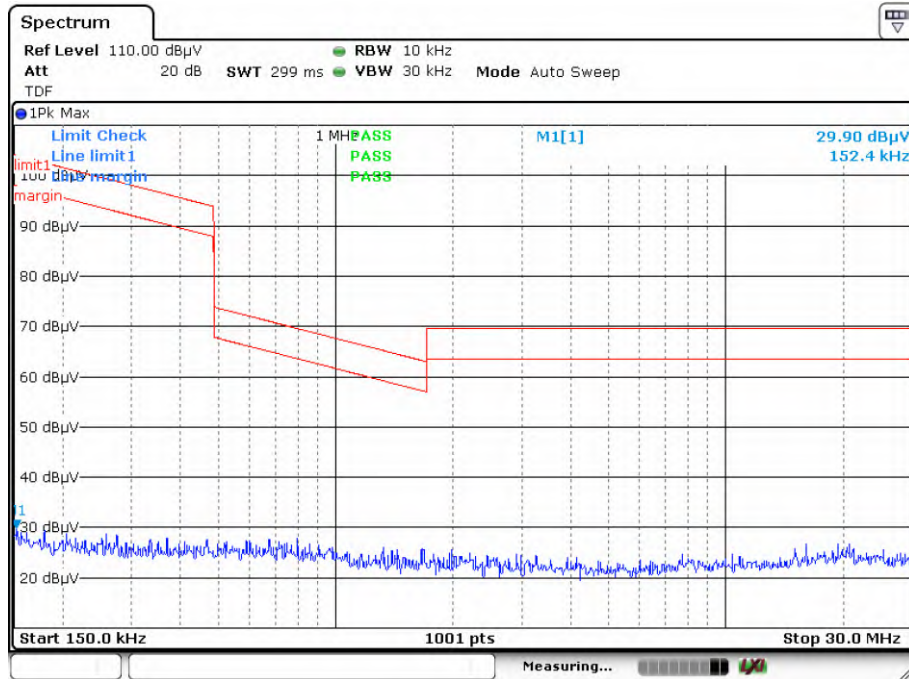
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9KHz - 30MHz, Low Energy mode	5
30MHz - 1GHz, BDR mode	8
30MHz - 1GHz, Low Energy mode	14
1GHz - 18GHz, BDR mode	20
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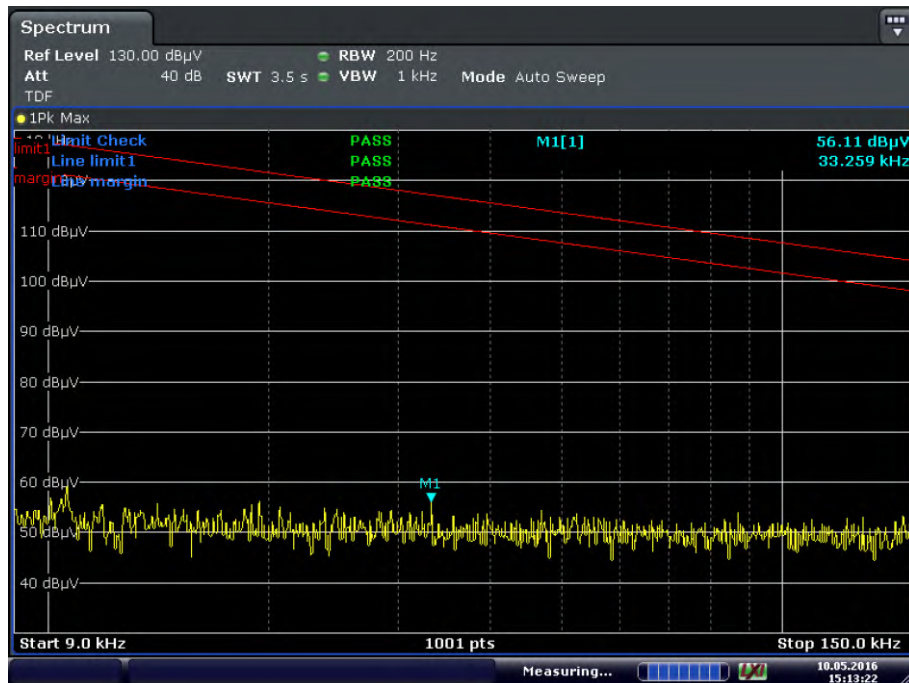
Note: The measurements with active loop antenna were greater than 20dB below the limit, so Radiated Spurious Emissions (9kHz – 30MHz) tests were applied on BDR mode only.

Appendix B.1: Test Plots of Radiated Spurious Emission

9KHz - 30MHz, BDR mode







9KHz - 30MHz, Low Energy mode

