FCC PART 15 SUBPART C SECTION 15.247

&

RSS 247, RSS GEN
TEST REPORT

for

BLE MODULE

Model: ATBTLC1000-ZR110CA

Prepared for

MICROCHIP TECHNOLOGY INC.
2355 W CHANDLER BLVD.
CHANDLER ARIZONA 85224

Prepared by: _____

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DATE: APRIL 1st, 2016

	REPORT BODY	APPENDICES					TOTAL
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GENERAL REPORT SUMMARY

This electromagnetic emission test report is generated by Compatible Electronics Inc., which is an independent testing and consulting firm. The test report is based on testing performed by Compatible Electronics personnel according to the measurement procedures described in the test specifications given below and in the "Test Procedures" section of this report.

The measurement data and conclusions appearing herein relate only to the sample tested and this report may not be reproduced in any form unless done so in full with the written permission of Compatible Electronics.

This report must not be used to claim product certification, approval or endorsement by NVLAP, NIST, or any agency of the federal government.

Device Tested:	BLE Module Model: ATBTLC1000-ZR110CA S/N: None
Product Description:	The EUT is a BLE Wireless Shielded Module with a chip antenna.
Modifications:	The EUT was not modified in order to comply with specifications.
Manufacturer:	Microchip Technology Inc. 2355 W Chandler Blvd. Chandler Arizona 85224
Test Dates:	March 31, April 1, 2, 2016
Test Specifications:	EMI requirements CFR Title 47, Part 15 Subpart C Sections 15.205, 15.207, 15.209, & 15.247. RSS 247 & RSS GEN
Test Procedure:	ANSI C63.4 & C63.10, and KDB 558074 D01 v03r04.

SUMMARY OF TEST RESULTS

TEST	DESCRIPTION	RESULTS
1	Conducted RF Emissions, 150 kHz - 30 MHz	Complies with the limits of CFR Title 47 Part 15 Subpart C Section 15.207 and RSS GEN
2	Radiated RF Emissions & Harmonics, 9 kHz – 25,000 MHz	Complies with the limits of CFR Title 47 Part 15 Subpart C Sections 15.205, 15.209, and RSS GEN
3	DTS Bandwidth	Complies with CFR Title 47 Part 15 Subpart C Section 15.247 and RSS 247
4	Maximum Peak Conducted Output Power	Complies with CFR Title 47 Part 15 Subpart C Section 15.247 and RSS 247
5	Maximum Peak Power Spectral Density Level In The Fundamental Emission	Complies with CFR Title 47 Part 15 Subpart C Section 15.247 and RSS 247
6	Emissions in Non-Restricted Frequency Bands (in 100kHz Bandwidth)	Complies with CFR Title 47 Part 15 Subpart C Section 15.247 and RSS 247
7	Emissions in the Restricted Bands	Complies with CFR Title 47 Part 15 Subpart C Section 15.247 and RSS 247

1. PURPOSE

This document is a qualification test report based on the Electromagnetic Interference (EMI) tests performed on the BLE Module Model: ATBTLC1000-ZR110CA. The EMI measurements were performed according to the measurement procedure described in ANSI C63.10 & C63.4. The tests were performed in order to determine whether the electromagnetic emissions from the equipment under test, referred to as EUT (equipment under test) hereafter, are within the specification limits defined by the Code of Federal Regulations Title 47, Part 15 Subpart C sections 15.207, 15.205, 15.209, 15.247, RSS GEN, and RSS 247.

2. ADMINISTRATIVE DATA

2.1 Location of Testing

The tests described herein were performed at the test facility of Compatible Electronics, 20621 Pascal Way Lake Forest, California 92630.

2.2 Traceability Statement

The calibration certificates of all test equipment used during the test are on file at the location of the test. The calibration is traceable to the National Institute of Standards and Technology (NIST).

2.3 Cognizant Personnel

Microchip

Sanjay Malani

Compatible Electronics Inc.

Torey Oliver	Test Technician
Matt Harrison	Lab Manager

2.4 Date Test Sample was Received

The test sample was received on March 17, 2016.

2.5 Disposition of the Test Sample

The test sample remains at Compatible Electronics as of the date of this test report.

2.6 Abbreviations and Acronyms

The following abbreviations and acronyms may be used in this document.

RF	Radio Frequency
EMI	Electromagnetic Interference
EUT	Equipment Under Test
P/N	Part Number
S/N	Serial Number
HP	Hewlett Packard
ITE	Information Technology Equipment
CML	Corrected Meter Limit
LISN	Line Impedance Stabilization Network
NVLAP	National Voluntary Laboratory Accreditation Program
CFR	Code of Federal Regulations
PCB	Printed Circuit Board
TX	Transmit
RX	Receive

3. APPLICABLE DOCUMENTS

The following documents are referenced or used in the preparation of this Test Report.

SPEC	TITLE
CFR Title 47, Part 15	FCC Rules – Radio frequency devices (including digital devices)
ANSI C63.4 2014	Methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz.
RSS 247	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
RSS GEN	General Requirements for Compliance of Radio Apparatus
ANSI C63.10: 2013	American National Standard for Testing Unlicensed Wireless Devices
KDB 558074 D01 v03r05	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

4. DESCRIPTION OF TEST CONFIGURATION

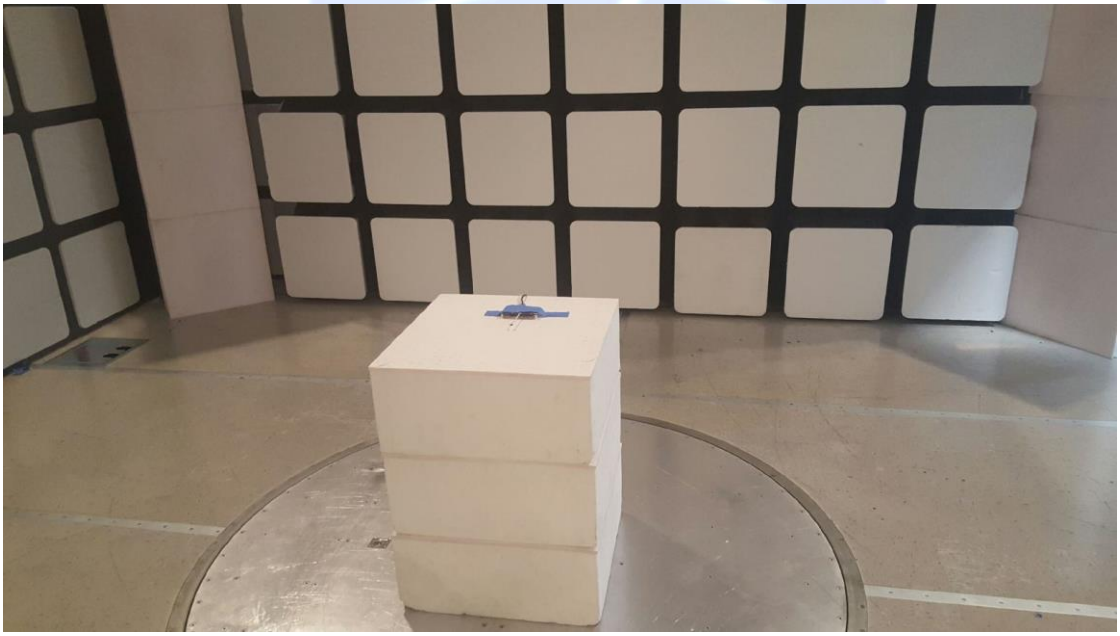
4.1 Description of Test Configuration

The BLE Module Model: ATBTLC1000-ZR110CA (EUT) was setup in a tabletop configuration. The EUT was powered by a DC Supply (for Conducted Emissions the EUT was connected to a USB Power Adapter). The EUT was continuously transmitting a data stream during transmit tests and continuously receiving during receiver tests. The EUT was checked in all axes and the X-Axis was found to be the worst case.

The voltage was varied ± 15% and the transmitting signal amplitude and frequency did not vary.

It was determined that the emissions were at their highest level when the EUT was transmitting in the configuration described above for Radiated Emissions. The final radiated data was taken in the above configuration. Please see Appendix E for the test data.

4.1.1 Photograph Test Configuration (X-Axis Shown)



4.1.2 Cable Construction and Termination

Cable 1-2

These are 2 meter, un-shielded, round cables that connect the EUT to the DC Power Supply. The cables were hardwired into the EUT and have banana connectors at the DC Supply end. The cables were not bundled.

Cable 3

This is a 10 centimeter, un-shielded, round cables that connect the EUT to the EUT Control Board. The cable is hardwired into both ends of the cable. The cable was not bundled.

Cable 4

This is a 1 meter, foil shielded, USB cable that connect the EUT to the USB Power Adapter. The cable is hardwired into both ends of the cable. The cable was not bundled. The shield of the cable was terminated at the connectors.

5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT

5.1 EUT and Accessory List

#	EQUIPMENT TYPE	MANU-FACTURER	MODEL	SERIAL NUMBER
1	BLE MODULE(EUT)	MICROCHIP	ATBTLC1000-ZR110CA	N/A
2	DC SUPPLY	MPJA	0-30V / 0-5A	017687
3	EUT CONTROL BOARD	MICROCHIP	NONE	NONE
4	USB POWER ADAPTER (CONDUCTED EMISSIONS)	BELKIN	F8J052	NONE

5.2 EMI Test Equipment

EQUIPMENT TYPE	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. DATE	CAL. DUE DATE
Computer	Compatible Electronics	NONE	NONE	N/A	N/A
EMI Receiver	Rohde & Schwarz	ESIB40	100219	9/3/2015	9/3/2016
Antenna, Loop	Com Power	AL-130	121049	12/06/2013	12/06/2016
Antenna, CombiLog	Com Power	AC-220	25857	5/21/2014	5/21/2016
Antenna, Horn 1-18GHz	Com Power	AH-118	071250	7/1/2014	7/1/2016
Antenna, Horn 18-26 GHz	Com Power	AH-826	081033	NCR	NCR
Pre-Amp, 1-18GHz	Com Power	PAM-118A	551034	8/25/2015	8/25/2016
Pre-Amp, 18-40GHz	Com Power	PA-840	181289	6/16/2014	6/16/2016
LISN	Com Power	LI-215	191937	4/16/2015	4/16/2016
RF Peak Power Meter/Analyzer	Boonton	4500A	1282	12/2/2014	12/2/2016
Peak Power Sensor	Boonton	57318	3723	12/2/2014	12/2/2016
High Pass Filter	AMTI Microwave Circuits	H3G020G4	481230	6/4/2015	6/4/2016
Mast, Antenna Positioner	Sunol Science Corporation	TWR 95-4	020808-3	N/A	N/A
Antenna Mast	Sunol Science Corporation	TWR 95-4	020808-3	N/A	N/A
Turntable	Sunol Science Corporation	FM 2001	N/A	N/A	N/A
Mast and Turntable Controller	Sunol Science Corporation	SC104V	020808-1	N/A	N/A

6. TEST SITE DESCRIPTION

6.1 Test Facility Description

Please refer to section 2.1 and the figures in Appendix D of this report for test location.

6.2 EUT Mounting, Bonding and Grounding

The EUT was mounted on a 1.0 by 1.5 by 0.8 meters high non-conductive table, which was placed on the ground plane.

For testing above 1 GHz the EUT was mounted 1.5 meter above the ground plane.

The EUT was grounded through the USB Cable.

6.3 Facility Environmental Characteristics

When applicable refer to the data sheets in Appendix E for the relative humidity, air temperature, and barometric pressure.

7. CHARACTERISTICS OF THE TRANSMITTER

7.1 Channel Number and Frequencies

There is a total of 40 channels. The low channel is at 2402.0 MHz and the high channel is at 2480.0 MHz. There is approximately 2 MHz separation between channels and the EUT uses GFSK modulation. Below are the channels and power settings:

Frequency	Gain Setting	
2402 MHz	DigGain=	DG= 27
2404-2478 MHz	DigGain=	DG= 20
2480 MHz	DigGain=	DG= 20

7.2 Antenna

The antenna is a chip antenna.

8. TEST PROCEDURES

The following sections describe the test methods and the specifications for the tests. Test results are also included in this section.

8.1 RF Emissions

8.1.1 Conducted Emissions Test

The EMI receiver was used as a measuring meter. A quasi-peak and/or average reading was taken only where indicated in the data sheets. The LISN output was measured using the EMI receiver. The output of the second LISN was terminated by a 50-ohm termination. The effective measurement bandwidth used for this test was 9 kHz.

Please see section 6.2 of this report for mounting, bonding, and grounding of the EUT. The EUT received its power through the LISN, which was bonded to the ground plane. The EUT was set up with the minimum distances from any conductive surfaces as specified in ANSI 63.4. The excess power cord was wrapped in a figure eight pattern to form a bundle not exceeding 0.4 meters in length.

The conducted emissions from the EUT were maximized for operating mode as well as cable placement. The final data was collected under program control by the computer software. The final qualification data is located in Appendix E.

Test Results:

The EUT complies with the limits of CFR Title 47 Part 15 Subpart C section 15.207 & RSS GEN.

8.1.2 Radiated Emissions (Spurious and Harmonics) Test

The R&S receiver was used as a measuring meter. The receiver was used in the peak detect mode with the "Max Hold" feature activated. In this mode, the receiver records the highest measured reading over all the sweeps. Amplifiers were used to increase the sensitivity of the instrument. There were two Microwave Preamplifier used for frequencies above 1 GHz.

For spurious emissions, the quasi-peak detector was used for frequencies below 1GHz and the average detector was used for frequencies above 1 GHz.

For the radiated Harmonic emissions and Band Edges a linear average detector was used.

The measurement bandwidths and transducers used for the radiated emissions test were:

FREQUENCY RANGE (MHz)	TRANSDUCER	EFFECTIVE MEASUREMENT BANDWIDTH
.009 to .150	Active Loop Antenna	200 Hz
.150 to 30	Active Loop Antenna	9 kHz
30 to 1000	Combilog Antenna	100 kHz (120kHz for QP Measurements)
1000 to 25000	Horn Antenna	1 MHz

The TDK FAC-3 shielded test chamber of Compatible Electronics, Inc. was used for radiated emissions testing. This test site is in full compliance with ANSI, EN 50147-2, and CISPR 22. Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The turntable supporting the EUT is remote controlled using a motor. The turntable permits EUT rotation of 360 degrees in order to maximize emissions. Also, the antenna mast allows height variation of the antenna from 1 meter to 4 meters. Data was collected in the worst case (highest emission) configuration of the EUT. At each reading, the EUT was rotated 360 degrees and the antenna height was varied from 1 to 4 meters in both vertical and horizontal polarizations (for E field radiated field strength).

Test Results:

The EUT complies with the limits of CFR Title 47 Part 15 Subpart C sections 15.205, 15.209, 15.247, RSS 247, and RSS GEN.

8.1.3 DTS Bandwidth

The DTS Bandwidth was measured directly connected to the EMI Receiver using a RBW of 100 kHz and a VBW of 300 kHz. A peak detector and a max hold trace were used with auto sweep time. The trace was allowed to fully maximize. We measured the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission. The automatic bandwidth measurement capability of the EMI Receiver was employed using the n dB bandwidth mode with n set to 6 dB. The final qualification data sheets are located in Appendix E.

Test Results:

The EUT complies with Part 15, Subpart C, Section 15.247 and RSS 247.

8.1.4 Maximum Peak Conducted Output Power

The maximum peak conducted output power was measured using a Peak Power Meter. The Peak Power Meter used a resolution bandwidth that is greater than the DTS bandwidth and a video bandwidth greater than 3 x RBW. The final qualification data sheets are located in Appendix E.

Test Results:

The EUT complies with Part 15, Subpart C, Section 15.247 and RSS 247.

8.1.5 Maximum Peak Power Spectral Density Level in The Fundamental Emission

The Maximum Peak Power Spectral Density Level in the Fundamental Emission was measured directly connected to the EMI Receiver. Tuned to the center frequency of the DTS channel and set the span to 1.5 times the DTS bandwidth. RBW was set to minimum 3 kHz but not > 100kHz and VBW 3 * RBW. A peak detector was used with the sweep time set to auto. A max hold trace was used and allowed to fully stabilize. The peak marker function was used to determine the maximum amplitude level within the RBW. The final qualification data sheets are located in Appendix E.

Test Results:

The EUT complies with Part 15, Subpart C, Section 15.247 and RSS 247.

8.1.6 Emissions in Non-Restricted Frequency Bands (in 100kHz Bandwidth)

The Emissions in Non-Restricted Frequency Bands (in 100kHz Bandwidth) measurements were performed using the EMI Receiver directly connected to the EUT. A reference level was established by setting the instrument center frequency to DTS channel center frequency. The span was set to ≥ 1.5 times the DTS bandwidth. The RBW was 100 kHz and VBW 300 kHz. A peak detector was used with a sweep time set to auto. A max hold trace was used and allowed to fully stabilize. The peak marker function was used to determine the level and 20dB below that was the reference level. For Emission Level Measurement, the center frequency and span were set to encompass the frequency range to be measured. RBW was set to 100 kHz and VBW to 300 kHz. A peak detector was used with a sweep time set to auto. The number of measurement points were greater than span/RBW. A max hold trace was used and allowed to fully stabilize. The peak marker function was used to determine the maximum amplitude level. The final qualification data sheets are located in Appendix E.

Test Results:

The EUT complies with Part 15, Subpart C, Section 15.247 and RSS 247.

8.1.7 Emissions in the Restricted Bands (Radiated)

The Emissions in the Restricted Bands measurement was performed using the EMI Receiver at a 3-meter test distance to obtain the final test data. The final qualification data sheets are located in Appendix E.

Test Results:

The EUT complies with Part 15 Subpart C, Section 15.205 and RSS GEN.

8.1.8 Emissions Radiated Outside of the Fundamental Frequency Band

The Band Edge measurement was performed using the EMI Receiver at a 3-meter test distance to obtain the final test data. The low and high channels were tuned to during the low and high band edge tests. The final qualification data sheets are located in Appendix E.

Test Results:

The EUT complies with Part 15, Subpart C, Section 15.247 and RSS 247.

9. TEST PROCEDURE DEVIATIONS

The test procedures were not deviated from throughout all tests.

10. CONCLUSIONS

The BLE Module Model: ATBTLC1000-ZR110CA meets all of the relevant specification requirements defined in the Code of Federal Regulations Title 47, Part 15 Subpart C sections 15.205, 15.207, 15.209, 15.247, RSS GEN & RSS 247.

APPENDIX A

LABORATORY ACCREDITATIONS AND RECOGNITIONS

LABORATORY ACCREDITATIONS AND RECOGNITIONS

NVLAP LAB CODES 200063-0, 200528-0, 200527-0

For US, Canada, Australia/New Zealand, Taiwan and the European Union, Compatible Electronics is currently accredited by NVLAP to ISO/IEC 17025 an ISO 9002 equivalent. Please follow the link to the NIST site for each of our facilities NVLAP certificate and scope of accreditation.

NVLAP listing links

Agoura Division - http://ts.nist.gov/Standards/scopes/2000630.htm
Brea Division - http://ts.nist.gov/Standards/scopes/2005280.htm
Silverado/Lake Forest Division - http://ts.nist.gov/Standards/scopes/2005270.htm

ANSI listing

CETCB
https://www.ansica.org/wwwversion2/outside/ALLdirectoryDetails.asp?menuID=1&prgID=3&orgID=123&status=4

Compatible Electronics has been nominated as a Conformity Assessment Body (CAB) for EMC under the US/EU Mutual Recognition Agreement (MRA).

Compatible Electronics has been nominated as a Conformity Assessment Body (CAB) for Taiwan/BSMI under the US/APEC (Asia-Pacific Economic Cooperation) Mutual Recognition Agreement (MRA).

We are also certified/listed for IT products by the following country/agency:

VCCI Listing, from VCCI site

Enter "Compatible" in search form http://www.vcci.or.jp/vcci_e/activity/registration/setsubi.html

FCC Listing, from FCC OET site

FCC test lab search https://fjallfoss.fcc.gov/oetcf/eas/reports/TestFirmSearch.cfm

Industry Canada Industrie Canada

Compatible Electronics IC listing can be found at:
http://www.ic.gc.ca/eic/site/ic1.nsf/eng/home

APPENDIX B

MODIFICATIONS TO THE EUT

MODIFICATIONS TO THE EUT

There were no modifications made during testing.

APPENDIX C

ADDITIONAL MODELS COVERED UNDER THIS REPORT

ADDITIONAL MODELS COVERED UNDER THIS REPORT

USED FOR THE PRIMARY TEST	BLE Module Model: ATBTLC1000-ZR110CA S/N: None

No additional models were tested.

APPENDIX D

DIAGRAMS, FACTORS, CHARTS, AND PHOTOS

FIGURE 1: PLOT MAP AND LAYOUT OF TEST SITE BELOW 1GHZ

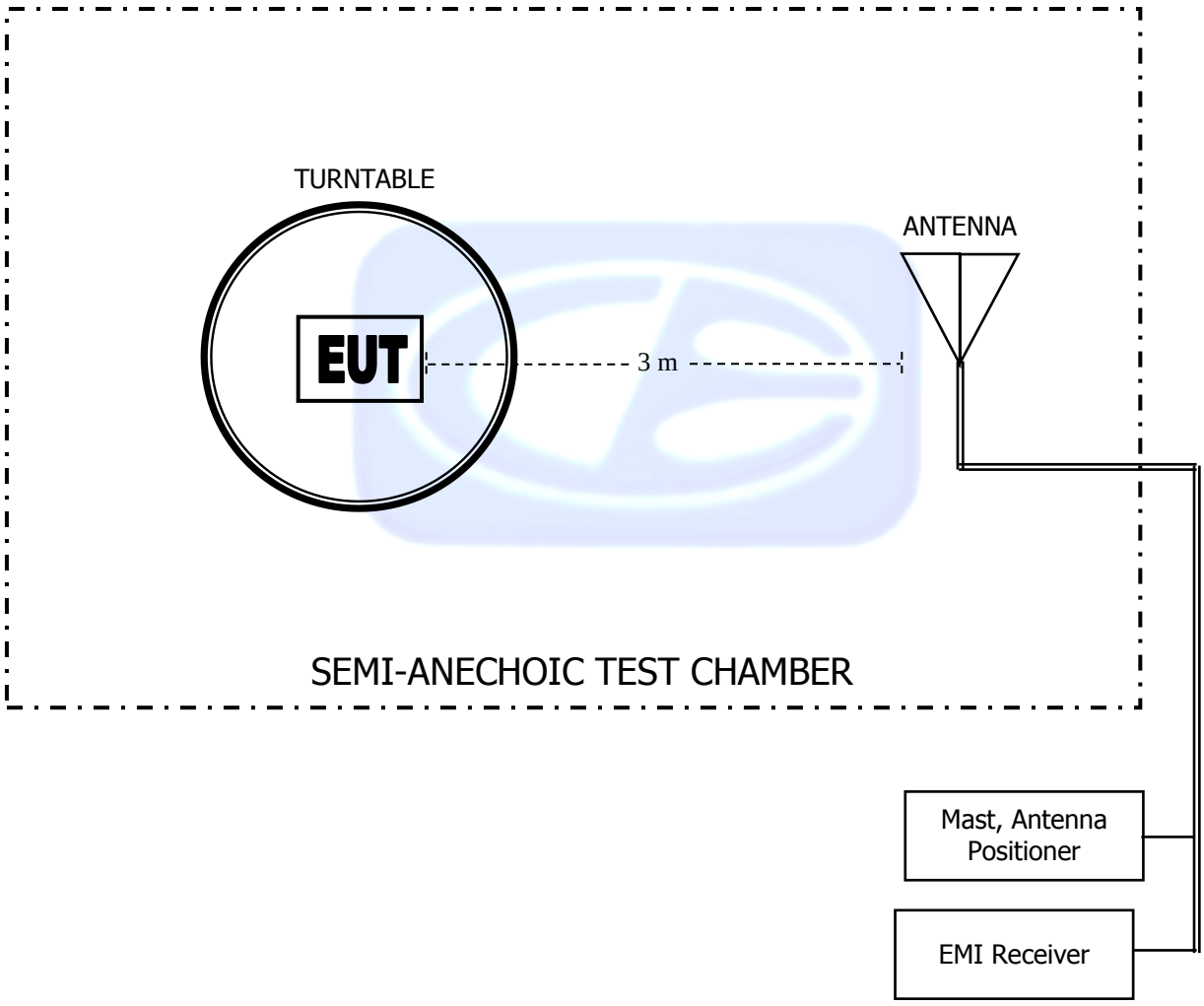


FIGURE 2: PLOT MAP AND LAYOUT OF TEST SITE ABOVE 1GHZ

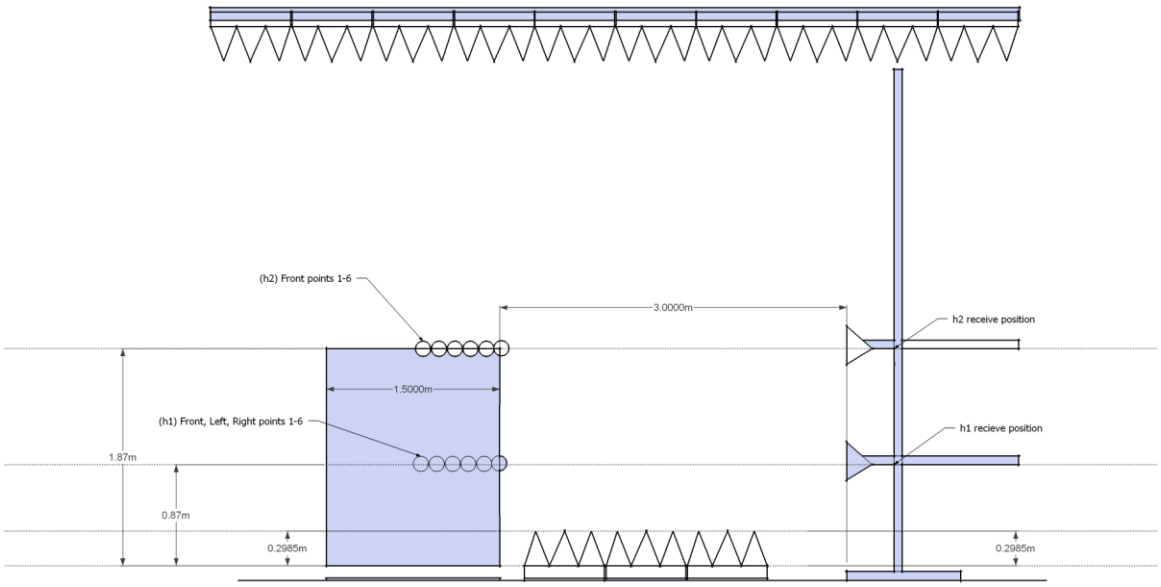
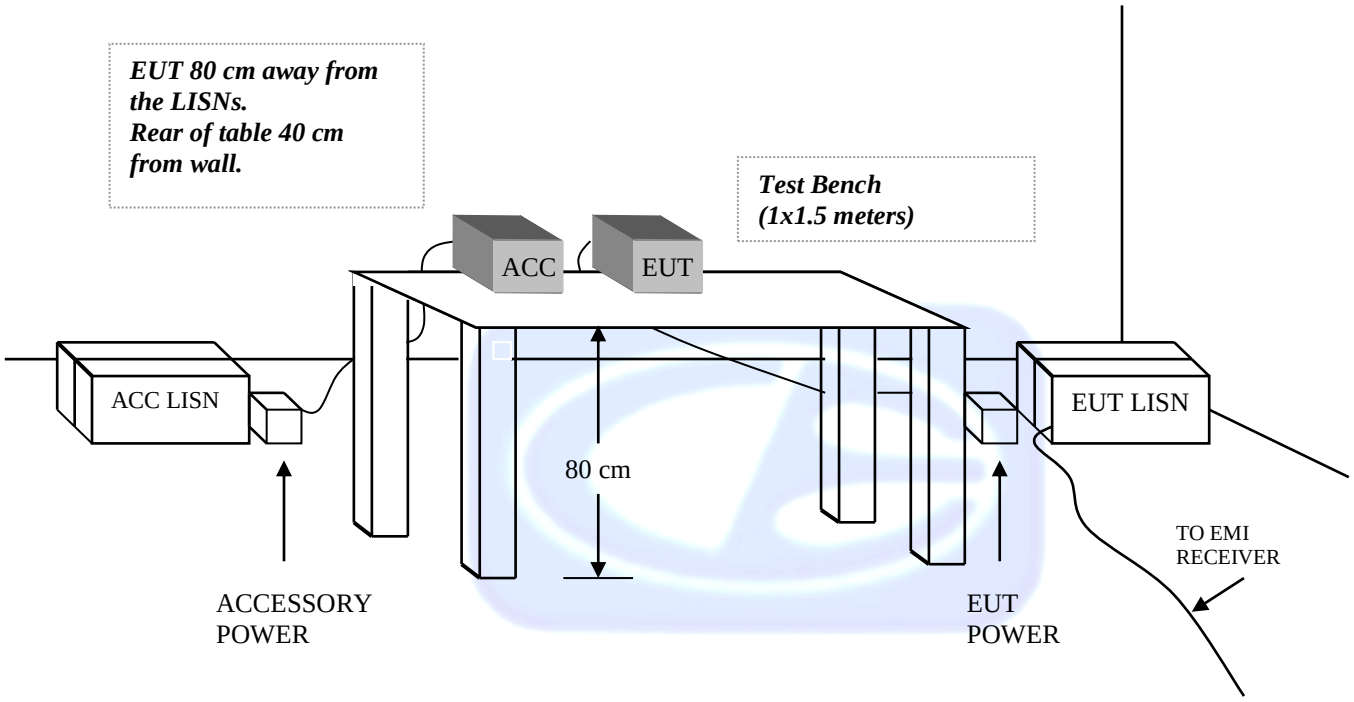


FIGURE 3: CONDUCTED EMISSIONS TEST SETUP



COM-POWER AL-130

LOOP ANTENNA

S/N: 121049

CALIBRATION DUE: DECEMBER 6, 2016

FREQUENCY (MHz)	MAGNETIC (dB/m)	ELECTRIC (dB/m)	FREQUENCY (MHz)	MAGNETIC (dB/m)	ELECTRIC (dB/m)
0.009	-34.64	16.86	**0.8**	-36.32	15.18
0.01	-34.78	16.72	**0.9**	-36.22	15.28
0.02	-35.91	15.59	**1.0**	-36.22	15.28
0.03	-35.48	16.02	**2.0**	-35.91	15.59
0.04	-35.82	15.68	**3.0**	-35.91	15.59
0.05	-36.49	15.01	**4.0**	-36.01	15.49
0.06	-36.30	15.20	**5.0**	-35.80	15.70
0.07	-36.43	15.07	**6.0**	-36.00	15.50
0.08	-36.30	15.20	**7.0**	-35.90	15.60
0.09	-36.39	15.11	**8.0**	-35.70	15.80
0.1	-36.41	15.09	**9.0**	-35.70	15.80
0.2	-36.61	14.89	**10.0**	-35.60	15.90
0.3	-36.63	14.87	**15.0**	-36.52	14.98
0.4	-36.52	14.99	**20.0**	-35.75	15.75
0.5	-36.63	14.87	**25.0**	-37.78	13.72
0.6	-36.62	14.88	**30.0**	-38.62	12.88
0.7	-36.53	14.97			

COM-POWER AC-220

LAB R - COMBILOG ANTENNA

S/N: 25857

CALIBRATION DUE: MAY 21, 2016

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
30	22.5	**160**	13.3
35	22.5	**180**	15.0
40	23.0	**200**	14.6
45	21.5	**250**	16.5
50	21.3	**300**	18.1
60	18.2	**400**	19.4
70	13.2	**500**	21.4
80	11.6	**600**	21.6
90	11.9	**700**	23.7
100	12.6	**800**	26.0
120	15.1	**900**	26.6
140	13.6	**1000**	28.5

COM-POWER AH-118

HORN ANTENNA

S/N: 071250

CALIBRATION DUE: JULY 1, 2016

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
1000	30.1	**9500**	44.2
1500	29.2	**10000**	43.4
2000	31.6	**10500**	44.6
2500	35.5	**11000**	45.1
3000	33.7	**11500**	45.7
3500	36.0	**12000**	46.2
4000	35.4	**12500**	45.4
4500	35.5	**13000**	44.8
5000	40.1	**13500**	46.7
5500	37.8	**14000**	47.8
6000	39.0	**14500**	46.4
6500	39.9	**15000**	47.2
7000	40.4	**15500**	45.5
7500	44.4	**16000**	45.0
8000	44.1	**16500**	44.5
8500	43.1	**17000**	47.0
9000	43.0	**17500**	47.8
		18000	44.2

COM-POWER PAM-118A

1-18GHz - PREAMPLIFIER

S/N: 551034

CALIBRATION DUE: AUGUST 251, 2017

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
500	36.77	**5500**	39.82
1000	38.63	**6000**	38.74
1100	38.72	**6500**	39.60
1200	38.97	**7000**	35.52
1300	38.59	**7500**	36.61
1400	39.18	**8000**	36.92
1500	38.71	**8500**	37.13
1600	39.28	**9000**	36.50
1700	39.25	**9500**	38.92
1800	39.06	**10000**	38.74
1900	40.34	**11000**	35.23
2000	40.07	**12000**	35.64
2500	39.69	**13000**	36.73
3000	40.94	**14000**	36.48
3500	40.41	**15000**	37.57
4000	40.44	**16000**	38.10
4500	41.20	**17000**	37.34
5000	39.35	**18000**	36.80

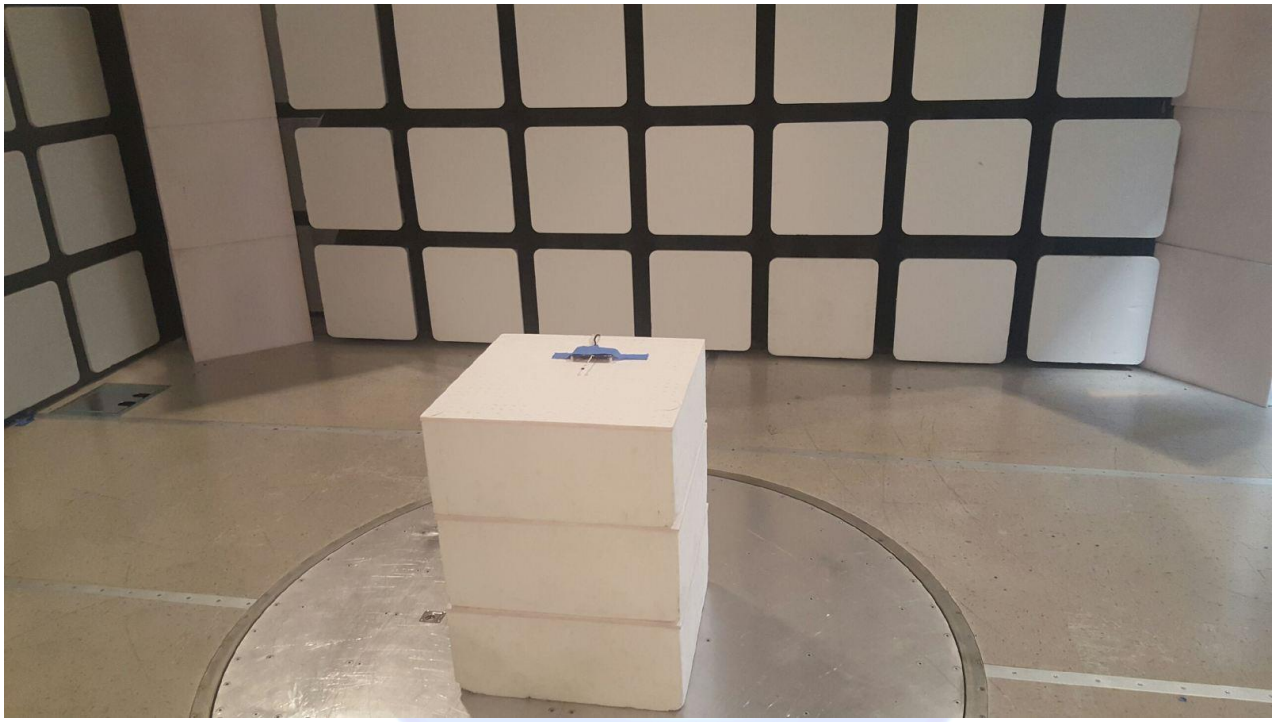
COM-POWER PA-840

18-40 GHz PREAMPLIFIER

S/N: 181289

CALIBRATION DUE: JUNE 16, 2016

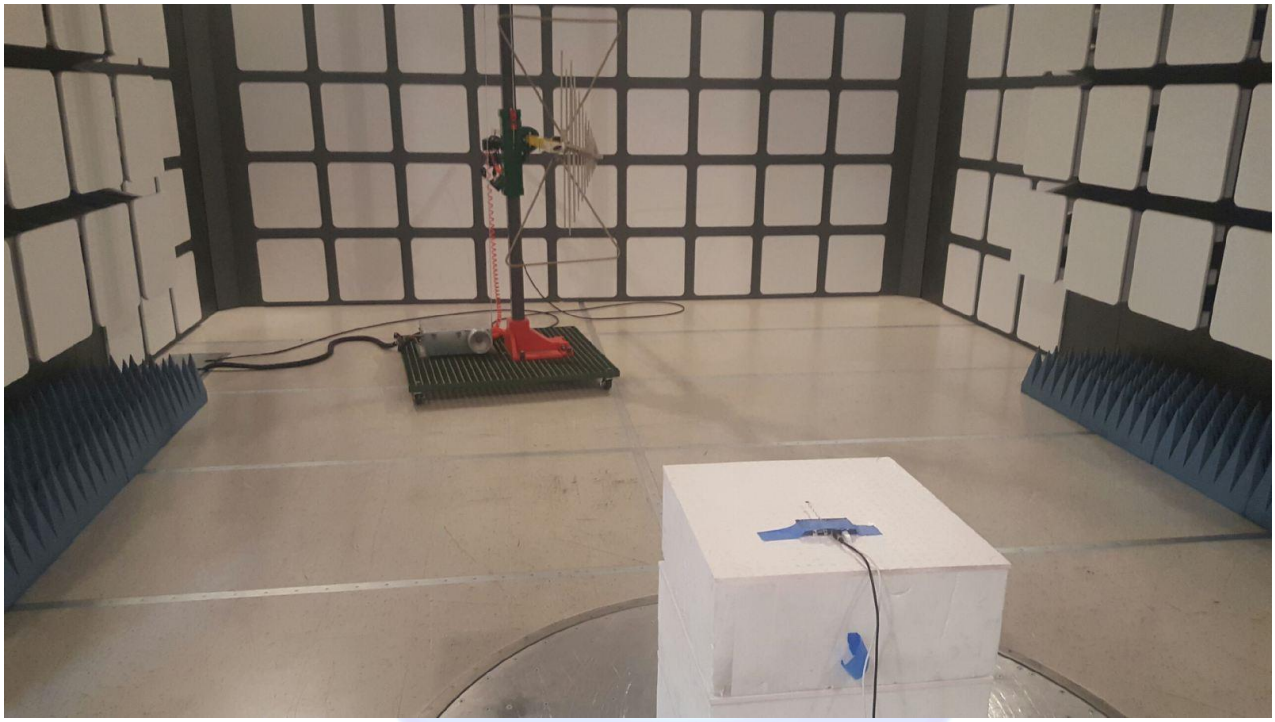
FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
18000	29.4	**31500**	28.2
19000	28.8	**32000**	28.6
20000	30.5	**32500**	28.8
21000	31.4	**33000**	28.2
22000	31.2	**33500**	27.7
23000	30.1	**34000**	27.2
24000	30.3	**34500**	28.2
25000	29.8	**35000**	27.3
26000	30.5	**35500**	27.2
26500	30.7	**36000**	27.2
27000	30.8	**36500**	27.5
27500	30.2	**37000**	27.0
28000	30.1	**37500**	26.7
28500	30.2	**38000**	26.2
29000	30.1	**38500**	26.5
29500	29.8	**39000**	26.3
30000	29.2	**39500**	26.9
30500	28.4	**40000**	27.6
31000	29.8		



FRONT VIEW

MICROCHIP
BLE MODULE
Model: ATBTLC1000-ZR110CA
FCC SUBPART C - RADIATED EMISSIONS < 1GHz

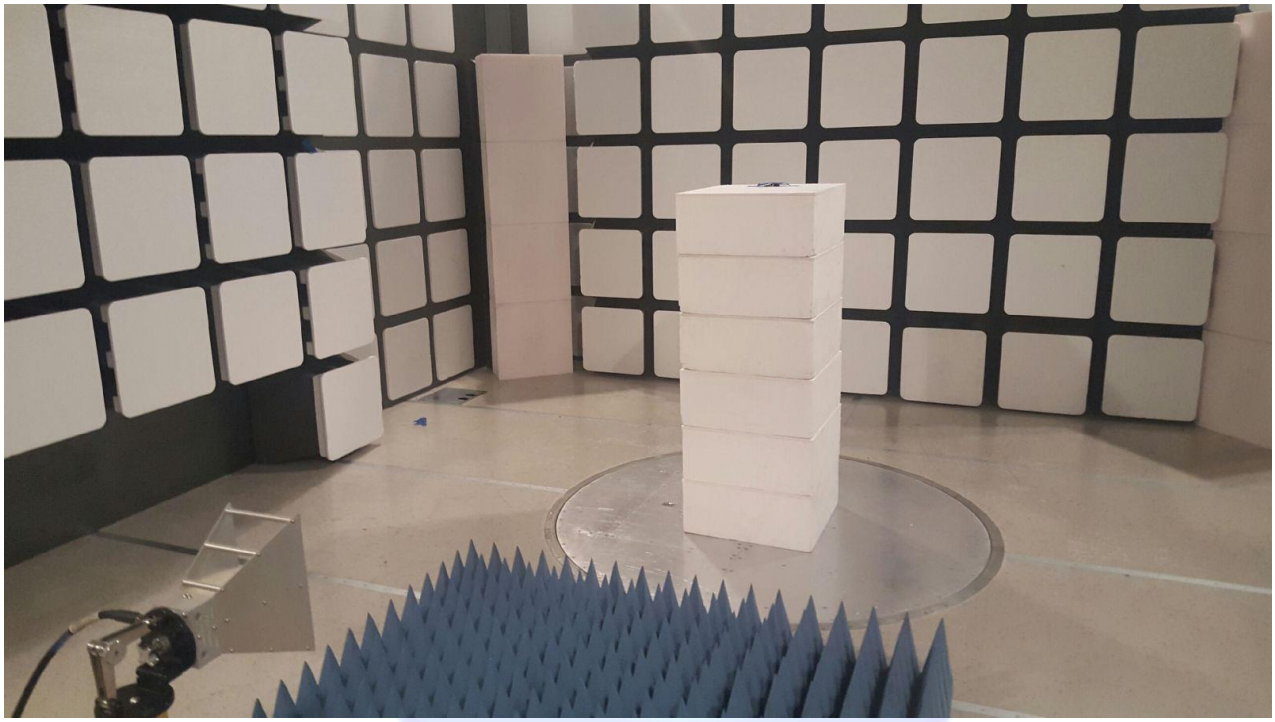
PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS



REAR VIEW

MICROCHIP
BLE MODULE
Model: ATBTLC1000-ZR110CA
FCC SUBPART C - RADIATED EMISSIONS < 1GHz

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS



FRONT VIEW

MICROCHIP
BLE MODULE
Model: ATBTLC1000-ZR110CA
FCC SUBPART C - RADIATED EMISSIONS > 1GHz

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

REAR VIEW

MICROCHIP
BLE MODULE
Model: ATBTLC1000-ZR110CA
FCC SUBPART C - RADIATED EMISSIONS > 1GHz

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

FRONT VIEW

MICROCHIP
BLE MODULE
Model: ATBTLC1000-ZR110CA
FCC SUBPART C - CONDUCTED EMISSIONS

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

REAR VIEW

MICROCHIP
BLE MODULE
Model: ATBTLC1000-ZR110CA
FCC SUBPART C - CONDUCTED EMISSIONS

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

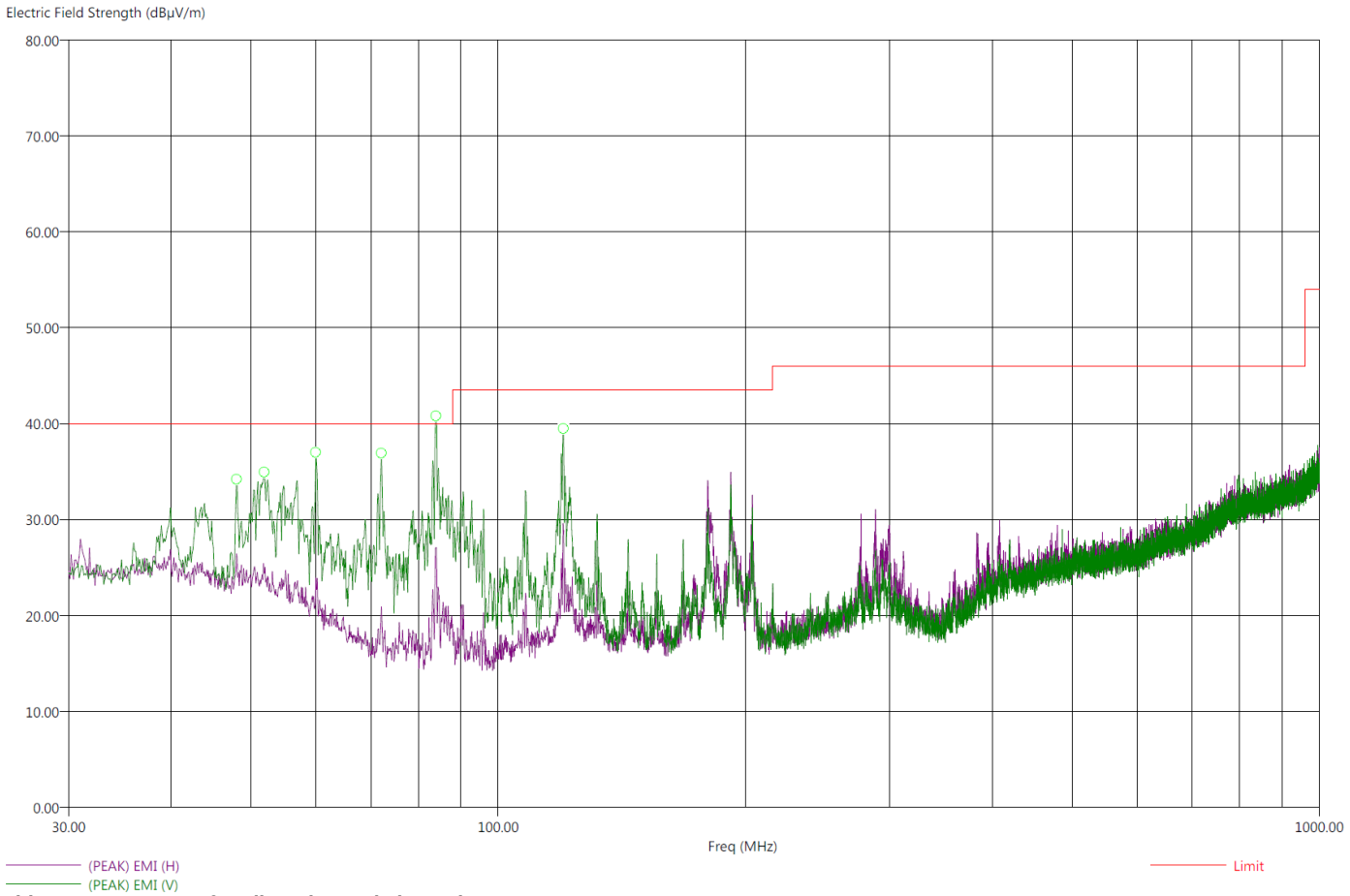
APPENDIX E

RADIATED EMISSIONS DATA SHEETS

Title: FCC 15.209 & RSS GEN
File: Radiated Pre-Scan 30-1000Mhz.set
Operator: Torey Oliver
EUT Type: BLE Module / ATBTLC1000-ZR110CA
EUT Condition: The EUT is constantly transmitting 2440 MHz.
Comments: Connected to remote laptop.
Temp: 71f
Hum: 43%
5VDC

4/1/2016 8:33:59 AM
Sequence: Preliminary Scan

Compatible Electronics, Inc. FAC-3 (Lab R)



This was worst case for all modes and channels
There were no radiated emissions besides harmonics found between 9kHz-30 MHz or 1GHz-25GHz.

Title: FCC 15.209 & RSS GEN 4/1/2016 9:10:24 AM
File: Radiated Final 30-1000Mhz.set Sequence: Final Measurements
Operator: Torey Oliver
EUT Type: BLE Module / ATBTLC1000-ZR110CA
EUT Condition: The EUT is constantly transmitting 2440 MHz.
Comments: Connected to remote laptop.
Temp: 71f
Hum: 43%
5VDC

Compatible Electronics, Inc. FAC-3 (Lab R)

Freq (MHz)	(QP) Margin (dB)	(QP) EMI (dBµV/m)	(PEAK) EMI (dBµV/m)	Limit (dBµV/m)	Pol	Ttbl Agl (deg)	Twr Ht (cm)	Transducer(dB)	Cable(dB)
48.00	-6.48	33.52	36.07	40.00	V	250.50	100.56	21.38	0.68
51.90	-6.74	33.26	36.18	40.00	V	15.00	104.86	20.67	0.70
60.00	-6.06	33.94	37.24	40.00	V	131.00	128.98	18.20	0.70
72.10	-5.79	34.21	37.88	40.00	V	155.25	137.64	12.85	0.82
84.00	-0.49	39.51	43.00	40.00	V	185.50	117.28	11.72	0.94
120.00	-7.02	36.50	39.35	43.52	V	121.75	145.58	15.10	1.25

This was worst case for all modes and channels
There were no radiated emissions besides harmonics found between 9kHz-30 MHz or 1GHz-25GHz.

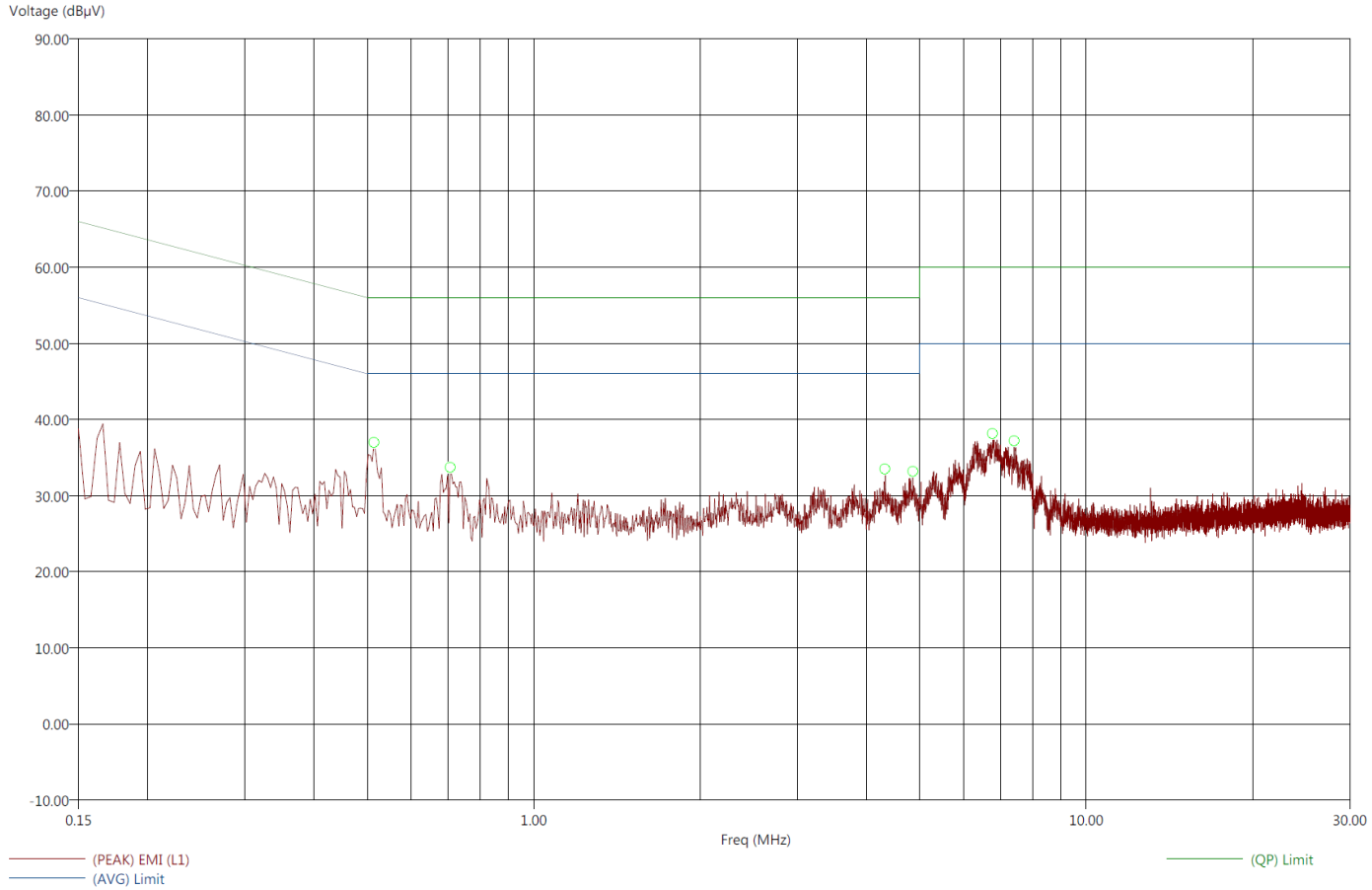
APPENDIX E

CONDUCTED EMISSIONS DATA SHEETS

Title: FCC 15.207 & RSS GEN
File: Conducted Pre-Line.set
Operator: Torey Oliver
EUT Type: BLE Module / ATBTLC1000-ZR110CA
EUT Condition: The EUT is constantly transmitting 2440 MHz.
Comments: Connected to remote laptop.
Temp: 71f
Hum: 43%
5VDC
Host: 120V 60Hz

4/1/2016 10:38:33 AM
Sequence: Preliminary Scan

Compatible Electronics, Inc. FAC-3 (LAB R)



This was worst case for all modes and channels

Title: FCC 15.207 & RSS GEN 4/1/2016 10:41:07 AM
File: Conducted Final-Line.set Sequence: Final Measurements
Operator: Torey Oliver
EUT Type: BLE Module / ATBTLC1000-ZR110CA
EUT Condition: The EUT is constantly transmitting 2440 MHz.
Comments: Connected to remote laptop.
Temp: 71f
Hum: 43%
5VDC
Host: 120V 60Hz

Compatible Electronics, Inc. FAC-3 (LAB R)

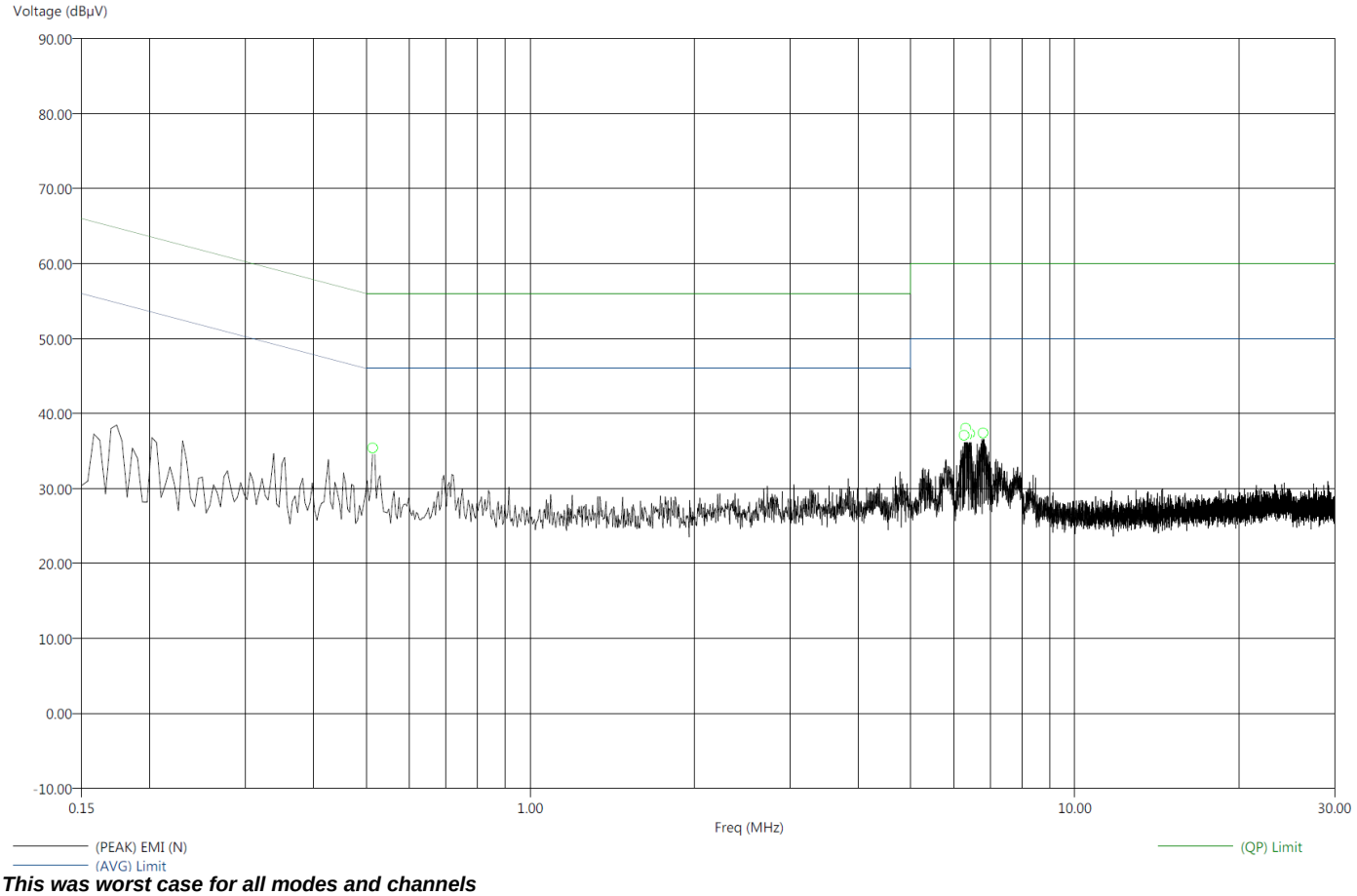
Freq (MHz)	(AVG) Margin AVL (dB)	(QP) Margin QPL (dB)	(AVG) EMI (dBµV)	(QP) EMI (dBµV)	(PEAK) EMI (dBµV)	(AVG) Limit (dBµV)	(QP) Limit (dBµV)	Transducer (dB)	Cable (dB)
0.51	-22.98	-24.86	23.02	31.14	36.21	46.00	56.00	0.03	0.10
0.71	-27.16	-29.66	18.84	26.34	31.95	46.00	56.00	0.03	0.10
4.33	-31.12	-34.16	14.88	21.84	26.56	46.00	56.00	0.04	0.17
4.85	-30.20	-33.10	15.80	22.90	28.14	46.00	56.00	0.04	0.19
6.78	-26.97	-28.87	23.03	31.13	36.46	50.00	60.00	0.03	0.20
7.40	-29.61	-31.81	20.39	28.19	33.11	50.00	60.00	0.02	0.20

This was worst case for all modes and channels

Title: FCC 15.207 & RSS GEN
File: Conducted Pre-Neutral.set
Operator: Torey Oliver
EUT Type: BLE Module / ATBTLC1000-ZR110CA
EUT Condition: The EUT is constantly transmitting 2440 MHz.
Comments: Connected to remote laptop.
Temp: 71f
Hum: 43%
5VDC
Host: 120V 60Hz

4/1/2016 10:44:00 AM
Sequence: Preliminary Scan

Compatible Electronics, Inc. FAC-3 (LAB R)



This was worst case for all modes and channels

Title: FCC 15.207 & RSS GEN 4/1/2016 10:47:28 AM
File: Conducted Final-Neutral.set Sequence: Final Measurements
Operator: Torey Oliver
EUT Type: BLE Module / ATBTLC1000-ZR110CA
EUT Condition: The EUT is constantly transmitting 2440 MHz.
Comments: Connected to remote laptop.
Temp: 71f
Hum: 43%
5VDC
Host: 120V 60Hz

Compatible Electronics, Inc. FAC-3 (LAB R)

Freq (MHz)	(AVG) Margin AVL (dB)	(QP) Margin QPL (dB)	(AVG) EMI (dBµV)	(QP) EMI (dBµV)	(PEAK) EMI (dBµV)	(AVG) Limit (dBµV)	(QP) Limit (dBµV)	Transducer (dB)	Cable (dB)
0.51	-25.47	-27.30	20.53	28.70	36.01	46.00	56.00	0.03	0.10
6.27	-34.89	-30.85	15.11	29.15	35.16	50.00	60.00	0.01	0.20
6.31	-34.16	-29.96	15.84	30.04	35.89	50.00	60.00	0.01	0.20
6.34	-34.50	-30.10	15.50	29.90	36.05	50.00	60.00	0.01	0.20
6.41	-35.84	-31.72	14.16	28.28	34.84	50.00	60.00	0.01	0.20
6.79	-32.85	-29.96	17.15	30.04	36.49	50.00	60.00	0.01	0.20

This was worst case for all modes and channels

DTS BANDWIDTH

DATA SHEETS

DTS BANDWIDTH

FCC 15.247 & RSS 247

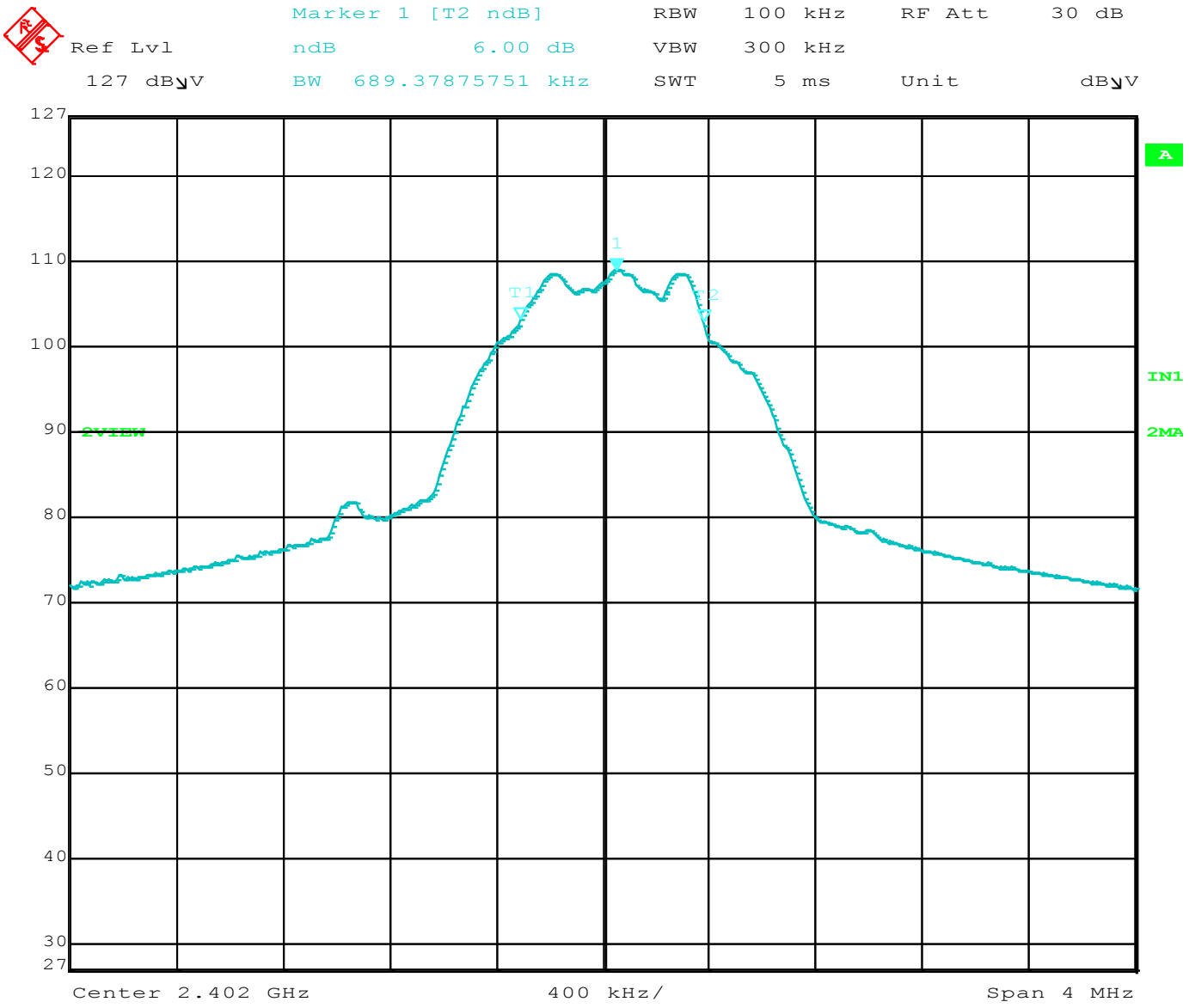
Company: Microchip
EUT: BLE Module
Model: ATBTLC1000-ZR110CA

Date: 4/1/2016
Lab: R
Test ENG: Torey Oliver

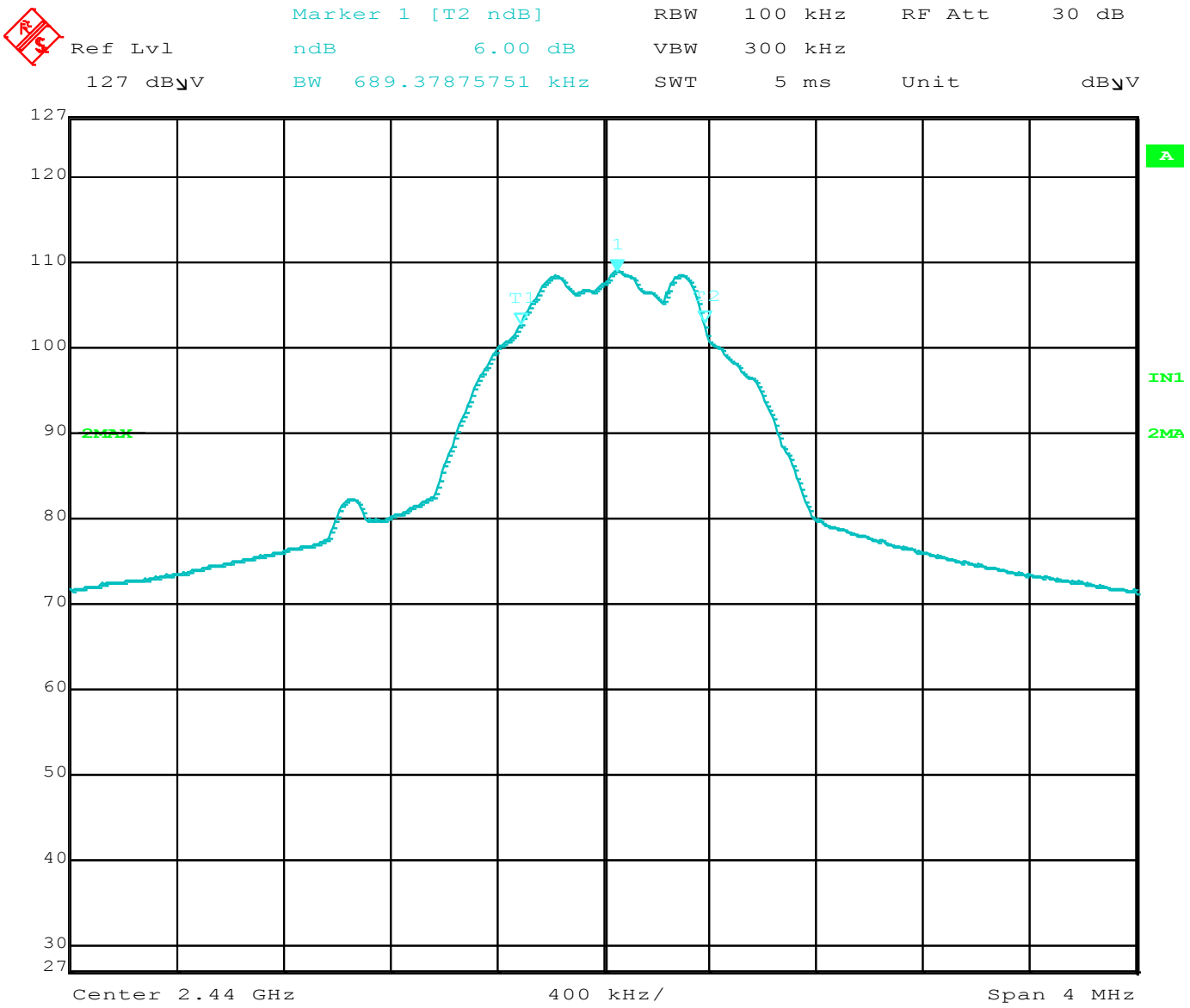
Compatible Electronics, Inc. FAC-3 (Lab R)

DTS Bandwidth

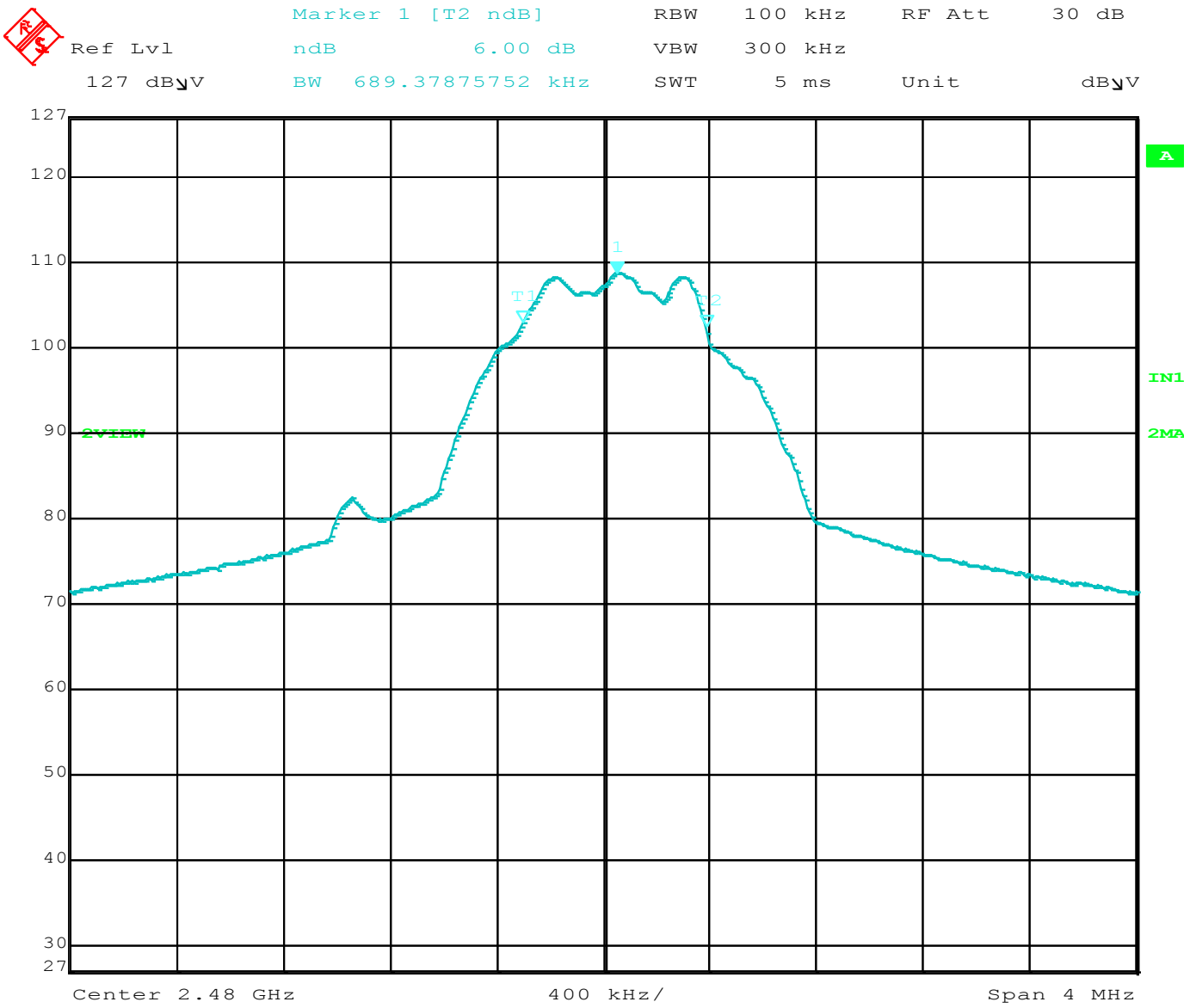
Freq. (MHz)	Measured BW (kHz)	Limit (Min) (kHz)	Margin (kHz)	Peak / QP / Avg	Comments
2402	689.38	500.00	189.38	Peak	
2440	689.38	500.00	189.38	Peak	
2480	689.38	500.00	189.38	Peak	



Comment A: DTS Bandwidth 2402 MHz
Date: 1.APR.2016 09:04:20



Comment A: DTS Bandwidth 2440 MHz
Date: 1.APR.2016 09:05:51



Comment A: DTS Bandwidth 2480 MHz
Date: 1.APR.2016 09:07:54

MAXIMUM PEAK CONDUCTED OUTPUT POWER

DATA SHEETS

MAXIMUM PEAK CONDUCTED OUTPUT POWER

FCC 15.247

Company:	Microchip	Date:	3/31/2016
EUT:	BLE Module	Lab:	R
Model:	ATBTLC1000-ZR110CA	Test ENG:	Torey Oliver
Mode:	BLE		

Compatible Electronics, Inc. FAC-3 (Lab R)

Freq. (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Peak / QP / Avg	Comments
2402	2.70	30.00	-27.30	Peak	
2440	2.64	30.00	-27.36	Peak	
2480	2.52	30.00	-27.48	Peak	

MAXIMUM PEAK POWER SPECTRAL DENSITY LEVEL IN THE FUNDAMENTAL EMISSION

DATA SHEETS

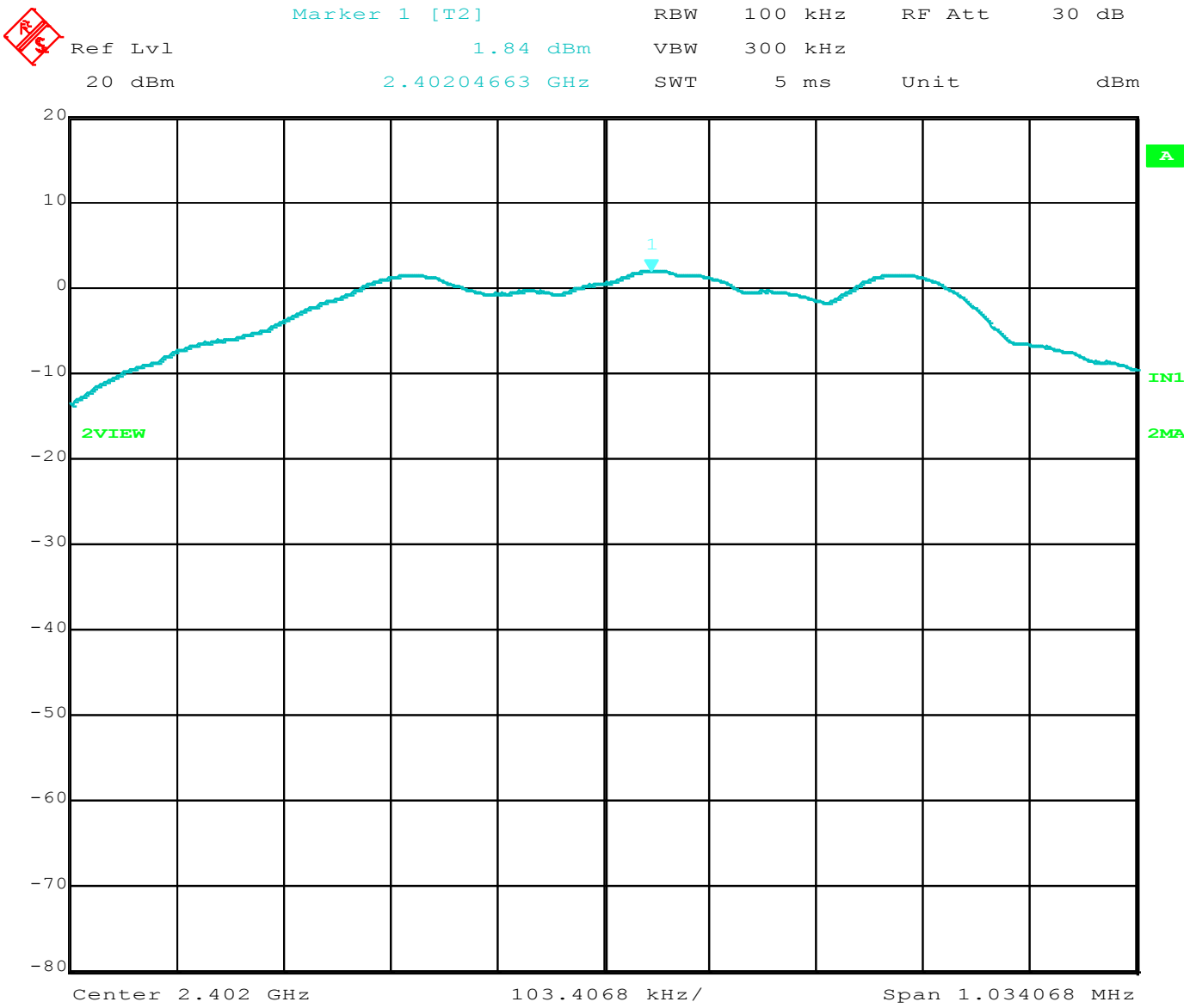
PEAK POWER SPECTRAL DENSITY

FCC 15.247

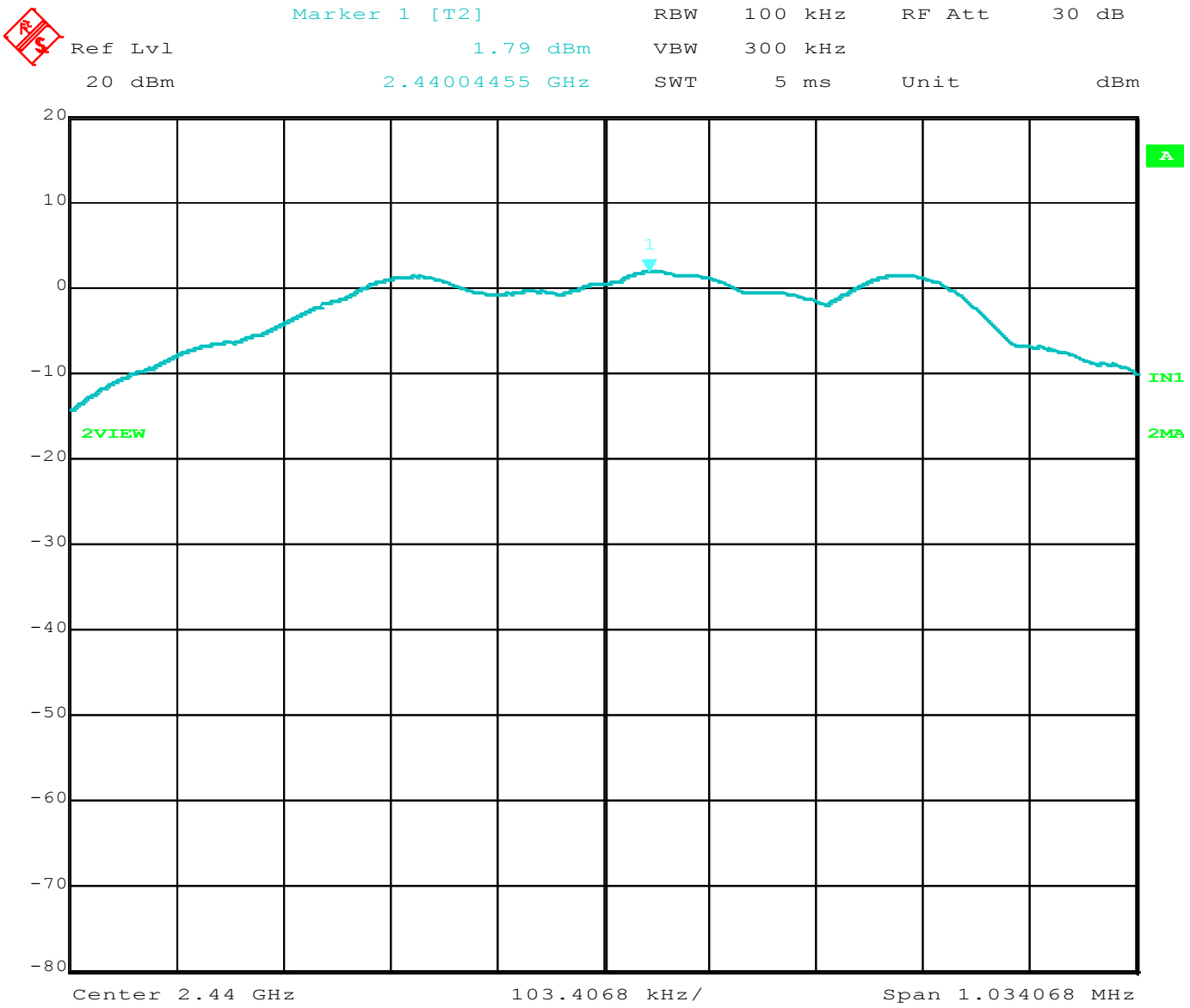
Company:	Microchip	Date:	4/1/2016
EUT:	BLE Module	Lab:	R
Model:	ATBTLC1000-ZR110CA	Test ENG:	Torey Oliver

Compatible Electronics, Inc. FAC-3 (Lab R)

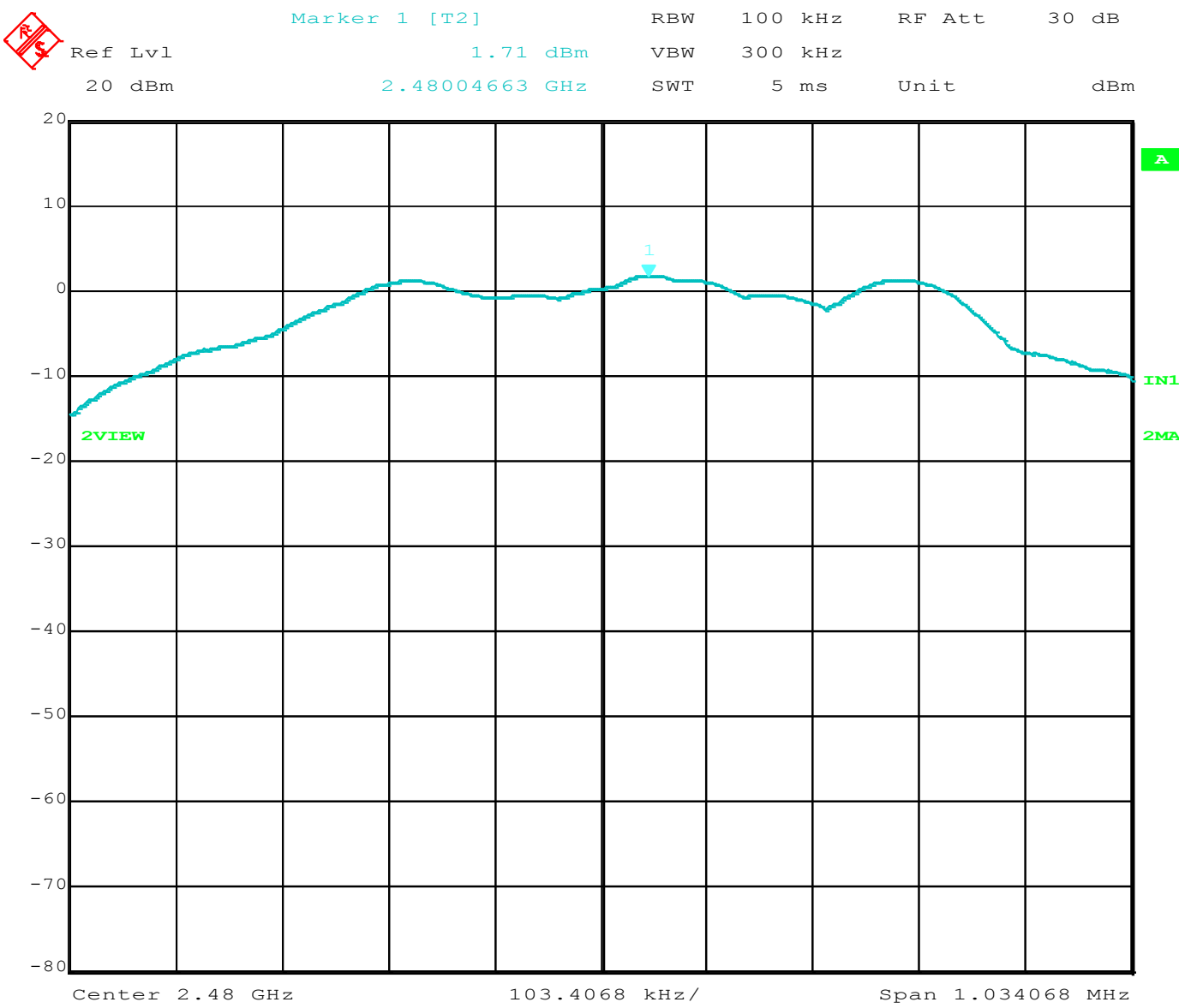
Freq. (MHz)	Peak (dBm)	Limit (dBm)	Margin (dB)	Peak / QP / Avg	Comments
2402	1.84	8.00	-6.16	Peak	
2440	1.79	8.00	-6.21	Peak	
2480	1.71	8.00	-6.29	Peak	



Comment A: Power Spectral Density 2402 MHz
Date: 1.APR.2016 09:12:16



Comment A: Power Spectral Density 2440 MHz
Date: 1.APR.2016 09:11:33



Comment A: Power Spectral Density 2480 MHz
Date: 1.APR.2016 09:10:29

HARMONIC EMISSIONS IN NON-RESTRICTED FREQUENCY BANDS (IN 100KHZ BANDWIDTH) / CONDUCTED

DATA SHEETS

HARMONIC EMISSIONS IN NON-RESTRICTED FREQUENCY BANDS

FCC 15.247

Company:	Microchip	Date:	4/1/2016
EUT:	BLE Module	Lab:	R
Model:	ATBTLC1000-ZR110CA	Test ENG:	Torey Oliver
Mode:	BLE		

Compatible Electronics, Inc. FAC-3 (Lab R)

Freq. (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Peak / QP / Avg	Comments
7206	52.77	88.84	-36.07	Peak	Low Channel
9760	52.80	88.79	-35.99	Peak	Mid Channel
24800	49.37	88.71	-39.34	Peak	High Channel

PSD reading used for reference level

EMISSIONS IN RESTRICTED FREQUENCY BANDS (RADIATED FIELD STRENGTH)

DATA SHEETS

HARMONIC EMISSIONS IN RESTRICTED FREQUENCY BANDS
Low Channel, Horizontal & Vertical

FCC 15.247

Company: Microchip
EUT: BLE Module
Model: ATBTLC1000-ZR110CA

Date: 3/31/2016
Lab: R
Test ENG: T. Oliver

Compatible Electronics, Inc. FAC-3 (Lab R)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4804.00	54.75	H	73.98	-19.23	Peak	1.16	286	**In Restricted Band**
4804.00	40.26	H	53.98	-13.72	Avg	1.16	286	
12010.00	71.95	H	73.98	-2.03	Peak	1.11	72	**In Restricted Band**
12010.00	52.14	H	53.98	-1.84	Avg	1.11	72	
19216.00		H	73.98		Peak			**In Restricted Band**
19216.00		H	54.93		Avg			No Emissions Found
4804.00	50.52	V	73.98	-23.46	Peak	1.04	13	**In Restricted Band**
4804.00	33.61	V	53.98	-20.37	Avg	1.04	13	
12010.00	67.84	V	73.98	-6.14	Peak	1.00	72	**In Restricted Band**
12010.00	48.66	V	53.98	-5.32	Avg	1.00	72	
19216.00		V	73.98		Peak			**In Restricted Band**
19216.00		V	54.93		Avg			No Emissions Found

Test distance
3 meter

HARMONIC EMISSIONS IN RESTRICTED FREQUENCY BANDS
Mid Channel, Horizontal & Vertical

FCC 15.247

Company: Microchip
EUT: BLE Module ATBTLC1000-ZR110CA
Model:

Date: 3/31/2016
Lab: R
Test ENG: Torey Oliver

Compatible Electronics, Inc. FAC-3 (Lab R)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4880.00	52.18	H	73.98	-21.80	Peak	1.32	80	**In Restricted Band**
4880.00	35.37	H	53.98	-18.61	Avg	1.32	80	
7320.00	68.01	H	73.98	-5.97	Peak	1.14	235	**In Restricted Band**
7320.00	46.77	H	53.98	-7.21	Avg	1.14	235	
12200.00	73.86	H	73.98	-0.12	Peak	1.00	69	**In Restricted Band**
12200.00	53.36	H	53.98	-0.62	Avg	1.00	69	
19520.00		H	73.98		Peak			**In Restricted Band**
19520.00		H	53.98		Avg			No Emission Found
4880.00	51.55	V	73.98	-22.43	Peak	1.59	21	**In Restricted Band**
4880.00	34.75	V	53.98	-19.23	Avg	1.59	21	
7320.00	56.09	V	73.98	-17.89	Peak	1.41	45	**In Restricted Band**
7320.00	46.78	V	53.98	-7.20	Avg	1.41	45	
12200.00	68.36	V	73.98	-5.62	Peak	1.50	83	**In Restricted Band**
12200.00	48.12	V	53.98	-5.86	Avg	1.50	83	
19520.00		V	73.98		Peak			**In Restricted Band**
19520.00		V	53.98		Avg			No emissions found

Test distance
3 meter

HARMONIC EMISSIONS IN RESTRICTED FREQUENCY BANDS
High Channel, Horizontal & Vertical

FCC 15.247

Company: Microchip
EUT: BLE Module ATBTLC1000-ZR110CA
Model:

Date: 3/31/2016
Lab: R
Test ENG: Torey Oliver

Compatible Electronics, Inc. FAC-3 (Lab R)

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
4960.00	59.93	H	73.98	-14.05	Peak	1.54	320	**In Restricted Band**
4960.00	46.00	H	53.98	-7.98	Avg	1.54	320	
7440.00	67.44	H	73.98	-6.54	Peak	1.58	222	**In Restricted Band**
7440.00	48.43	H	53.98	-5.55	Avg	1.58	222	
12400.00	73.89	H	73.98	-0.09	Peak	1.06	152	**In Restricted Band**
12400.00	52.86	H	53.98	-1.12	Avg	1.06	152	
19840.00		H	73.98		Peak			**In Restricted Band**
19840.00		H	53.98		Avg			No Emission Found
22320.00		H	73.98		Peak			**In Restricted Band**
22320.00		H	53.98		Avg			No Emission Found
4960.00	55.01	V	73.98	-18.97	Peak	1.47	33	**In Restricted Band**
4960.00	41.46	V	53.98	-12.52	Avg	1.47	33	
7440.00	66.77	V	73.98	-7.21	Peak	1.34	135	**In Restricted Band**
7440.00	48.14	V	53.98	-5.84	Avg	1.34	135	
12400.00	73.76	V	73.98	-0.22	Peak	1.27	89	**In Restricted Band**
12400.00	51.66	V	53.98	-2.32	Avg	1.27	89	
19840.00		V	73.98		Peak			**In Restricted Band**
19840.00		V	53.98		Avg			No Emission Found
22320.00		V	73.98		Peak			**In Restricted Band**
22320.00		V	53.98		Avg			No Emission Found

Test distance
3 meter

EMISSIONS RADIATED OUTSIDE OF THE FUNDAMENTAL FREQUENCY BAND AT BAND EDGES

DATA SHEETS

BAND EDGES- VERTICAL

FCC 15.247

Company:	Microchip	Date:	3/31/2016
EUT:	BLE Module	Lab:	R
Model:	ATBTLC1000-ZR110CA	Test ENG:	Torey Oliver
Mode:	BLE		

Compatible Electronics, Inc. FAC-3 (Lab R)

Freq. (MHz)	Level (dBµV)	Pol	Limit (dBµV)	Margin (dB)	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
2402.00	79.96	V	--	--	Peak	2.84	123	
2400.00	51.16	V	59.96	-8.80	Delta	2.84	123	From Peak
2384.02	52.60	V	73.98	-21.38	Peak	2.84	123	
2384.02	38.41	V	53.98	-15.57	Avg	2.84	123	
2480.00	76.06	V	--	--	Peak	1.00	196	
2489.64	52.11	V	73.98	-21.87	Peak	1.00	196	
2489.64	38.66	V	53.98	-15.32	Avg	1.00	196	

Test distance

3 meter

BAND EDGES- HORIZONTAL

FCC 15.247

Company:	Microchip	Date:	3/31/2016
EUT:	BLE Module	Lab:	R
Model:	ATBTLC1000-ZR110CA	Test ENG:	Torey Oliver
Mode:	BLE		

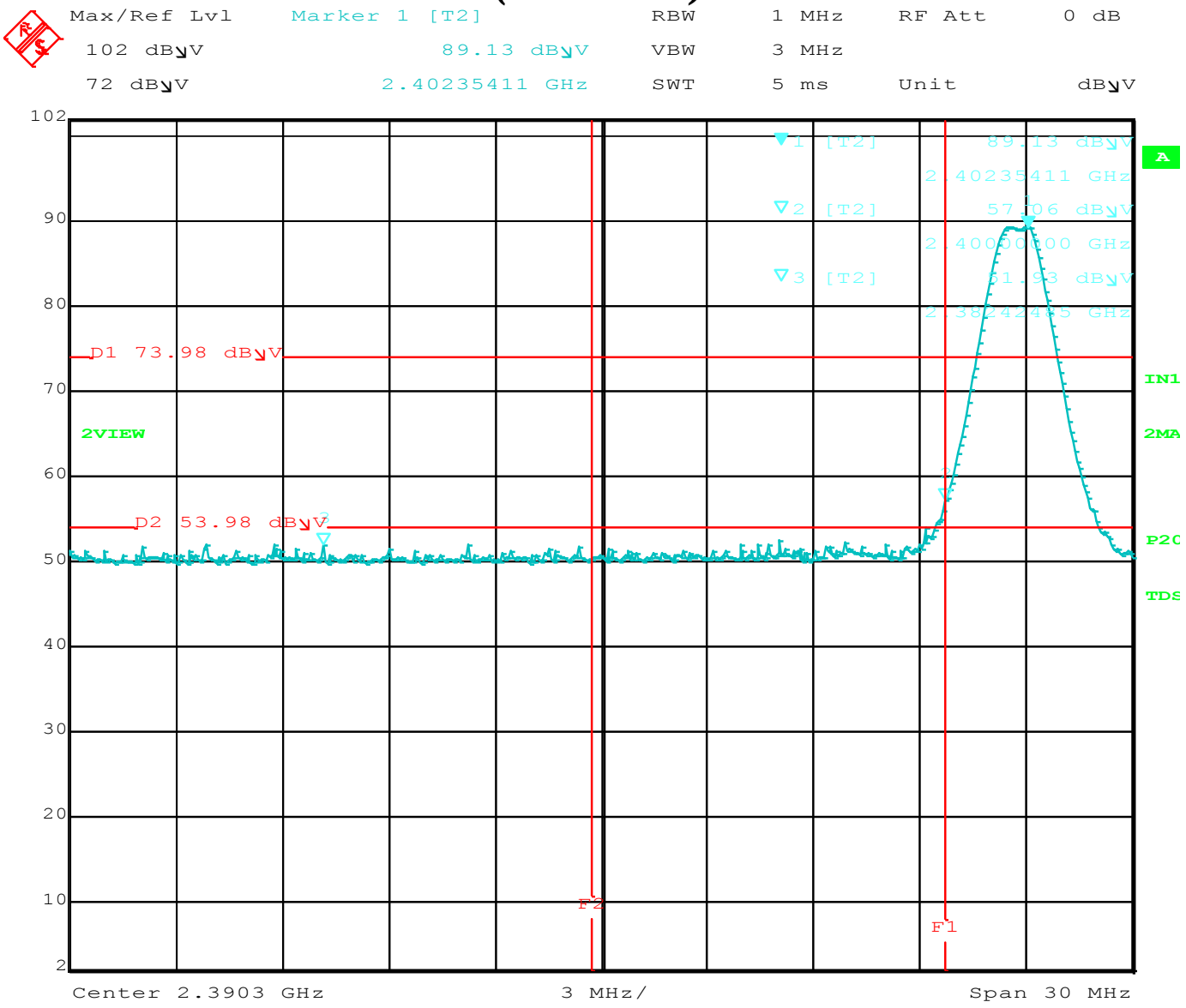
Compatible Electronics, Inc. FAC-3 (Lab R)

Freq. (MHz)	Level (dBµV)	Pol	Limit (dBµV)	Margin (dB)	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
2402.00	89.13	H	--	--	Peak	1.53	290	
2400.00	57.06	H	69.13	-12.07	Delta	1.53	290	From Peak
2382.42	51.93	H	73.98	-22.05	Peak	1.53	290	
2382.42	38.42	H	53.98	-15.56	Avg	1.53	290	
2480.00	88.63	H	--	--	Peak	1.72	210	
2491.27	52.02	H	73.98	-21.96	Peak	1.72	210	
2491.27	39.05	H	53.98	-14.93	Avg	1.72	210	

Test distance

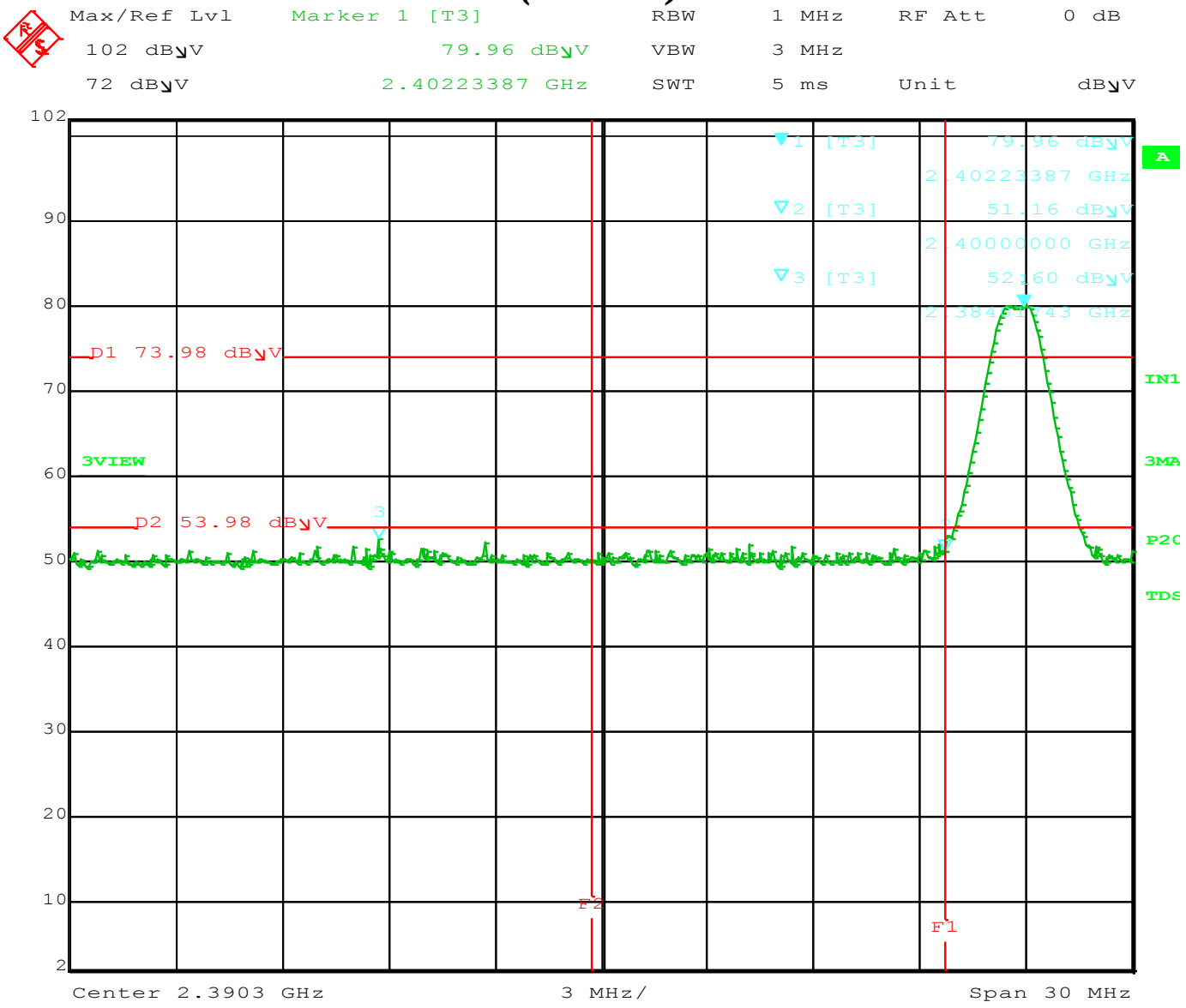
3 meter

LOWER BAND EDGE
(Horizontal)



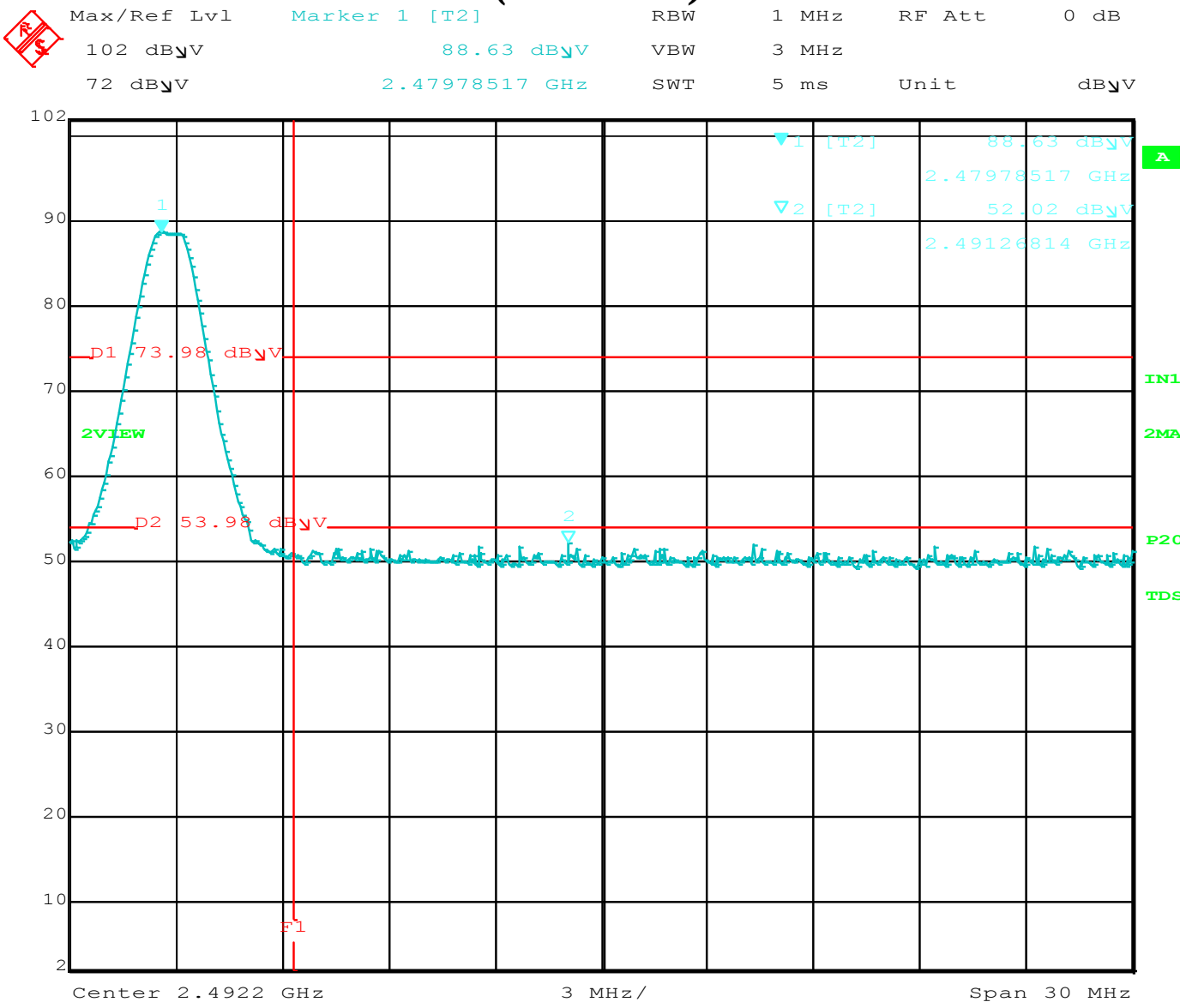
Comment A: Lower Band Edge Horizontal
Date: 31.MAR.2016 18:21:22

LOWER BAND EDGE
(Vertical)



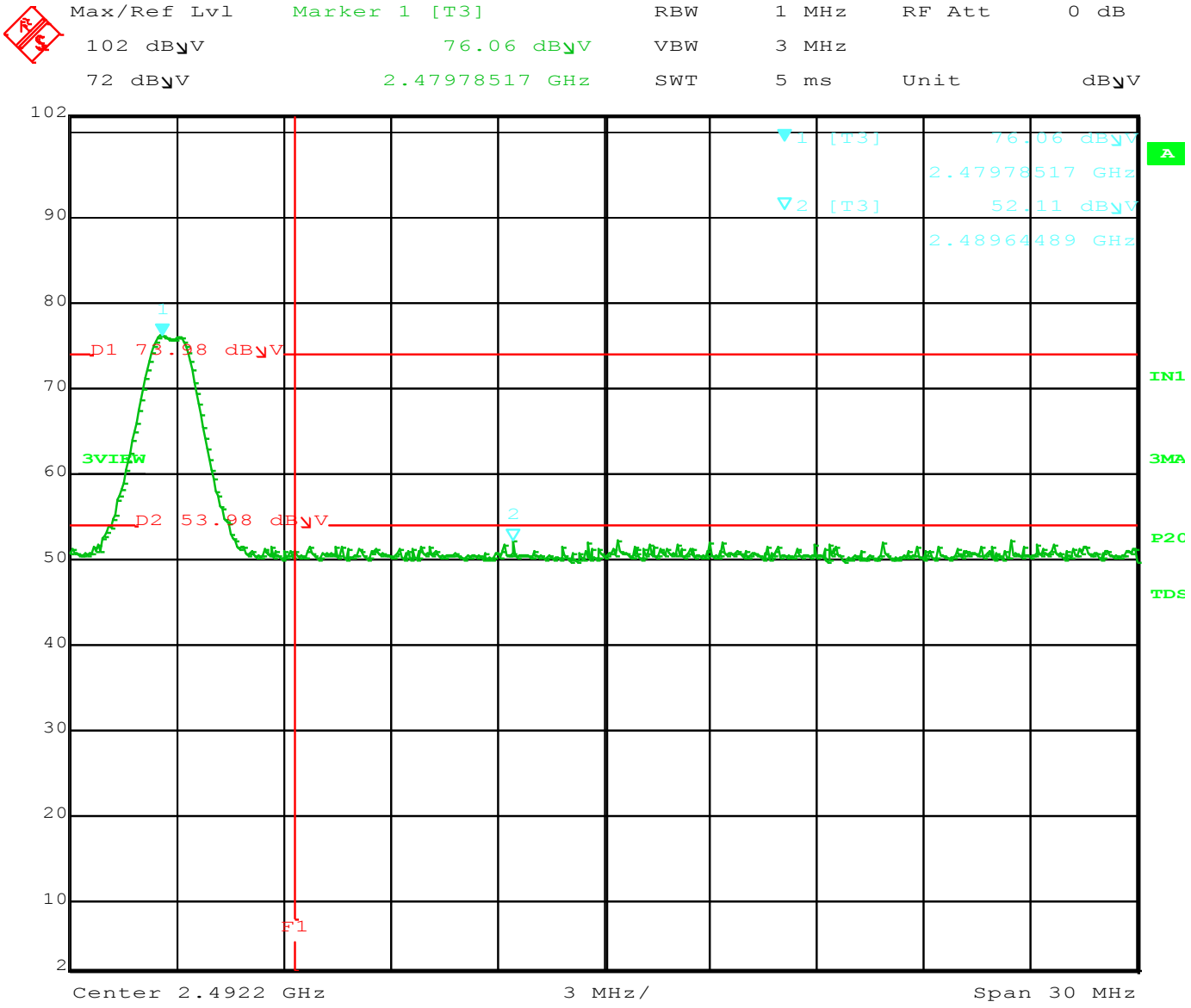
Comment A: Lower Band Edge Vertical
Date: 31.MAR.2016 18:25:21

UPPER BAND EDGE
(Horizontal)



Comment A: Upper Band Edge Horizontal
Date: 31.MAR.2016 18:32:00

UPPER BAND EDGE
(Vertical)



Comment A: Upper Band Edge Vertical
Date: 31.MAR.2016 18:35:13

OCCUPIED BANDWIDTH

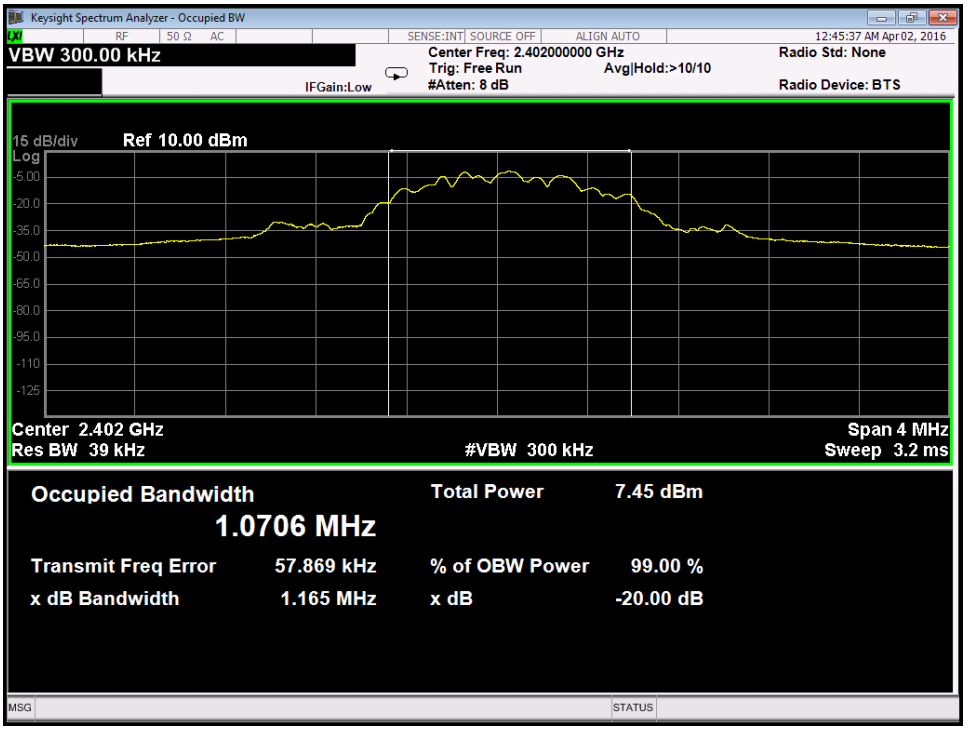
IC BANDWIDTH

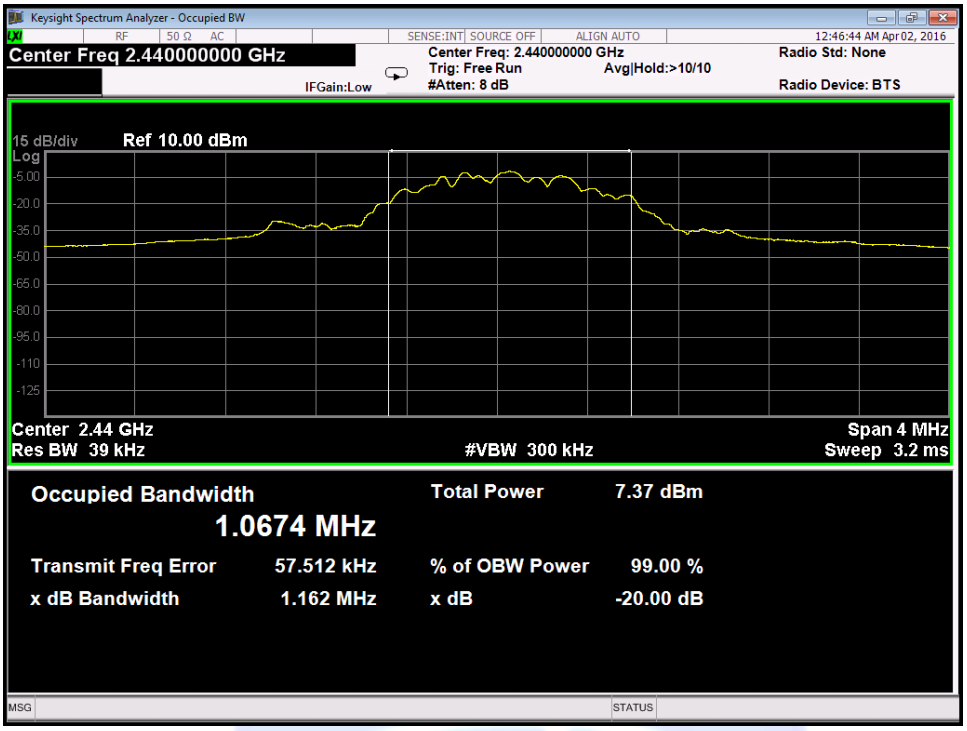
RSS GEN

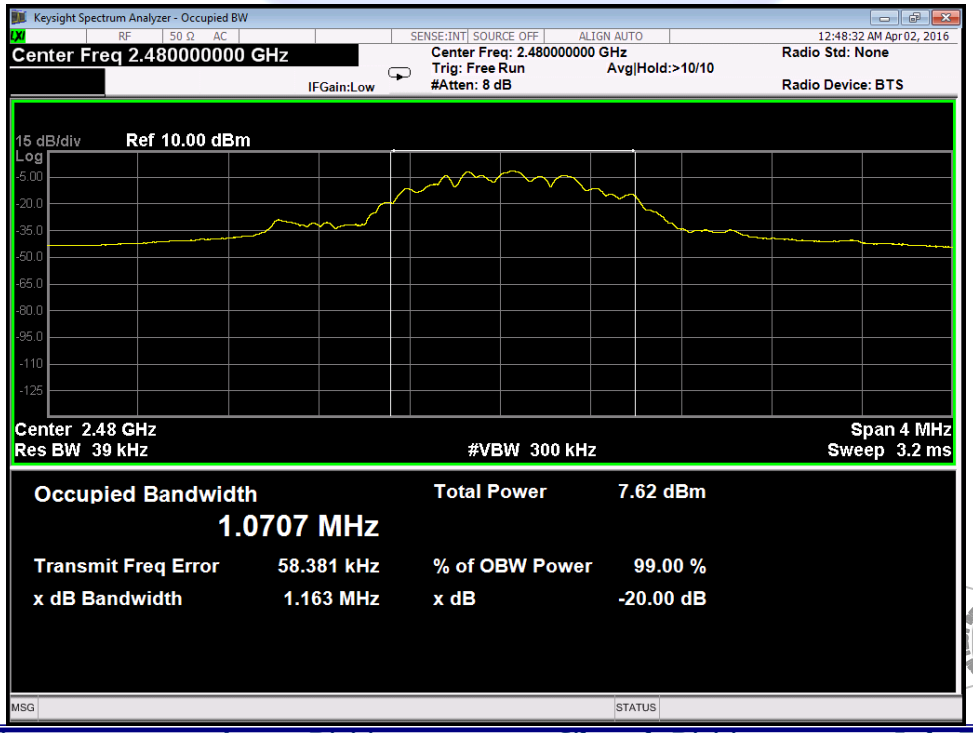
Company:	Microchip	Date:	4/2/2016
EUT:	BLE Module	Lab:	R
Model:	ATBTLC1000-ZR110CA	Test ENG:	Torey Oliver
Mode:	BLE		

Compatible Electronics, Inc. FAC-3 (Lab R)

Freq. (MHz)	Measured BW (kHz)	Comments
2402	1070.60	
2440	1067.40	
2480	1070.70	




Keysight Spectrum Analyzer - Occupied BW
RF 50 Ω AC
SENSE:INT SOURCE OFF ALIGN AUTO
12:46:44 AM Apr 02, 2016
Center Freq 2.440000000 GHz
Center Freq: 2.440000000 GHz
Trig: Free Run Avg|Hold:>10/10
#Atten: 8 dB
IFGain:Low
Radio Std: None
Radio Device: BTS
15 dB/div Ref 10.00 dBm
Log
-5.00
-20.0
-35.0
-50.0
-65.0
-80.0
-95.0
-110
-125
Center 2.44 GHz
Res BW 39 kHz
#VBW 300 kHz
Span 4 MHz
Sweep 3.2 ms
Occupied Bandwidth
1.0674 MHz
Total Power 7.37 dBm
Transmit Freq Error 57.512 kHz
% of OBW Power 99.00 %
x dB Bandwidth 1.162 MHz
x dB -20.00 dB
MSG
STATUS


Keysight Spectrum Analyzer - Occupied BW
RF 50 Ω AC
SENSE:INT SOURCE OFF ALIGN AUTO
12:48:32 AM Apr 02, 2016
Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run Avg|Hold:>10/10
#Atten: 8 dB
IFGain:Low
Radio Std: None
Radio Device: BTS
15 dB/div Ref 10.00 dBm
Log
-5.00
-20.0
-35.0
-50.0
-65.0
-80.0
-95.0
-110
-125
Center 2.48 GHz
Res BW 39 kHz
#VBW 300 kHz
Span 4 MHz
Sweep 3.2 ms
Occupied Bandwidth
1.0707 MHz
Total Power 7.62 dBm
Transmit Freq Error 58.381 kHz
% of OBW Power 99.00 %
x dB Bandwidth 1.163 MHz
x dB -20.00 dB
MSG
STATUS