RF TEST REPORT

SIEMIC
A Bureau Veritas Group Company

Report No.: FCC_RF_SL18110904-MED-081_BLE Rev 1
Supersede Report No.: FCC_RF_SL18110904-MED-081_BLE

Applicant	:	Medtronic Inc.
Product Name	:	Communicator
Model No.	:	4NR016
Test Standard	:	47 CFR 15.247
Test Method	:	ANSI C63.10: 2013 558074 D01 DTS Meas Guidance v05
FCC ID	:	LF54NR016
Dates of test	:	12/17/2018 to 12/24/2018
Issue Date	:	04/19/2019
Test Result	:	☒ Pass ☐ Fail
Equipment complied with the specification [X] Equipment did not comply with the specification [ ]		

This Test Report is Issued Under the Authority of:	
	
Shuo Zhang	**Shuo Zhang**
Test Engineer	Engineer Reviewer

Issued By:
SIEMIC Laboratories
775 Montague Expressway, Milpitas, 95035 CA

ilac-MRA
ACCREDITED
TESTING CERT # 2742-01

Laboratory Introduction

SIEMIC, headquartered in the heart of Silicon Valley, with superior facilities in US and Asia, is one of the leading independent testing and certification facilities providing customers with one-stop shop services for Compliance Testing and Global Certifications.

In addition to testing and certification, SIEMIC provides initial design reviews and compliance management throughout a project. Our extensive experience with China, Asia Pacific, North America, European, and International compliance requirements, assures the fastest, most cost effective way to attain regulatory compliance for the global markets.

Accreditations for Conformity Assessment

Country/Region	Accreditation Body	Scope
USA	FCC, A2LA	EMC, RF/Wireless, Telecom
Canada	IC, A2LA, NIST	EMC, RF/Wireless, Telecom
Taiwan	BSMI, NCC, NIST	EMC, RF, Telecom, Safety
Hong Kong	OFTA, NIST	RF/Wireless, Telecom
Australia	NATA, NIST	EMC, RF, Telecom, Safety
Korea	KCC/RRA, NIST	EMI, EMS, RF, Telecom, Safety
Japan	VCCI, JATE, TELEC, RFT	EMI, RF/Wireless, Telecom
Mexico	NOM, COFETEL, Caniety	Safety, EMC, RF/Wireless, Telecom
Europe	A2LA, NIST	EMC, RF, Telecom, Safety
Israel	MOC, NIST	EMC, RF, Telecom, Safety

Accreditations for Product Certifications

Country	Accreditation Body	Scope
USA	FCC TCB, NIST	EMC, RF, Telecom
Canada	IC FCB, NIST	EMC, RF, Telecom
Singapore	iDA, NIST	EMC, RF, Telecom
EU	NB	EMC & R&TTE Directive
Japan	MIC (RCB 208)	RF, Telecom
Hong Kong	OFTA (US002)	RF, Telecom

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1 Report Revision History

Report No.	Report Version	Description	Issue Date
FCC_RF_SL18110904-MED-081_BLE	None	Original	12/24/2018
FCC_RF_SL18110904-MED-081_BLE Rev 1	Rev 1	Add missing AC line Conducted data	04/19/2019

2 Executive Summary

The purpose of this test program was to demonstrate compliance of following product

Company: Medtronic Inc.
Product: Communicator
Model: 4NR016

against the current Stipulated Standards. The specified model product stated above has demonstrated compliance with the Stipulated Standard listed on 1st page.

3 Customer information

Applicant Name	:	Medtronic, Inc.
Applicant Address 1	:	8200 Coral Sea St. NE, Mounds View, MN 55112
Applicant Address 2	:	7000 Central Ave. NE, Minneapolis, MN 55432
Manufacturer Name	:	Medtronic, Inc.
Manufacturer Address 1	:	8200 Coral Sea St. NE, Mounds View, MN 55112
Manufacturer Address 2	:	7000 Central Ave. NE, Minneapolis, MN 55432

4 Test site information

Lab performing tests	SIEMIC Laboratories
Lab Address	775 Montague Expressway, Milpitas, CA 95035
FCC Test Site No.	540430
IC Test Site No.	4842D
VCCI Test Site No.	A0133

5 Modification

Index	Item	Description	Note
-	-	-	-

6 EUT Information

6.1 EUT Description

Product Name	Communicator
Model No.	4NR016
Trade Name	Medtronic Inc.
Serial No.	NKW018923N
Host Model No.	N/A
Input Power	3VDC
Power Adapter Manu/Model	N/A
Power Adapter SN	N/A
Date of EUT received	12/01/2018
Equipment Class/ Category	DTS
Port/Connectors	N/A

6.2 Radio Description

Bluetooth LE:

Radio Type	Bluetooth LE
Operating Frequency	2402MHz-2480MHz
Modulation	GFSK
Channel Spacing	2MHz
Antenna Type	Integral
Antenna Gain	-0.6dBi

7 Supporting Equipment/Software and cabling Description

7.1 Supporting Equipment

Item	Supporting Equipment Description	Model	Serial Number	Manufacturer	Note
N/A	N/A	N/A	N/A	N/A	N/A

7.2 Cabling Description

Name	Connection Start		Connection Stop		Length / shielding Info		Note
	From	I/O Port	To	I/O Port	Length (m)	Shielding	
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

7.3 Test Software Description

Test Item	Software	Description
RF Testing	xTM_Formal_Test_App_Executable_v6_0.exe	Set the EUT to transmit continuously in diferent test modes and channels

8 Test Summary

Test Item	Test standard		Test Method/Procedure		Pass / Fail
Restricted Band of Operation	FCC	15.205	FCC	ANSI C63.10:2013 558074 D01 DTS Meas Guidance v05	☒ Pass ☐ N/A
Antenna Requirement	FCC	15.203	FCC	ANSI C63.10 – 2013 558074 D01 DTS Meas Guidance v05	☒ Pass ☐ N/A
AC Conducted Emissions	FCC	15.207(a)	FCC	ANSI C63.10:2013	☒ Pass ☐ N/A

DTS Band Requirement

Test Item	Test standard		Test Method/Procedure		Pass / Fail
6dB Bandwidth	FCC	15.247(a)(2)	FCC	558074 D01 DTS Meas Guidance v05	☒ Pass ☐ N/A
Band Edge and Radiated Spurious Emissions	FCC	15.247(d)	FCC	ANSI C63.10:2013 558074 D01 DTS Meas Guidance v05	☒ Pass ☐ N/A
Output Power	FCC	15.247(b)	FCC	558074 D01 DTS Meas Guidance v05	☒ Pass ☐ N/A
Antenna Gain > 6 dBi	FCC	15.247(e)	FCC	-	☐ Pass ☒ N/A
Power Spectral Density	FCC	15.247(e)	FCC	558074 D01 DTS Meas Guidance v05	☒ Pass ☐ N/A
RF Exposure requirement	FCC	15.247(i)	FCC	-	☒ Pass ☐ N/A
Remark	1. All measurement uncertainties do not take into consideration for all presented test results.				

9 Measurement Uncertainty

Emissions			
Test Item	**Frequency Range**	**Description**	**Uncertainty**
AC Conducted Emissions	150KHz – 30MHz	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2	±3.5dB
RF conducted measurement	150KHz – 40GHz	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2	±0.95dB
Radiated Spurious Emissions	30MHz – 1GHz	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2 (for EUTs < 0.5m X 0.5m X 0.5m)	±6dB
Radiated Spurious Emissions	1GHz – 40GHz	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2 (for EUTs < 0.5m X 0.5m X 0.5m)	±6dB

10 Measurements, Examination and Derived Results

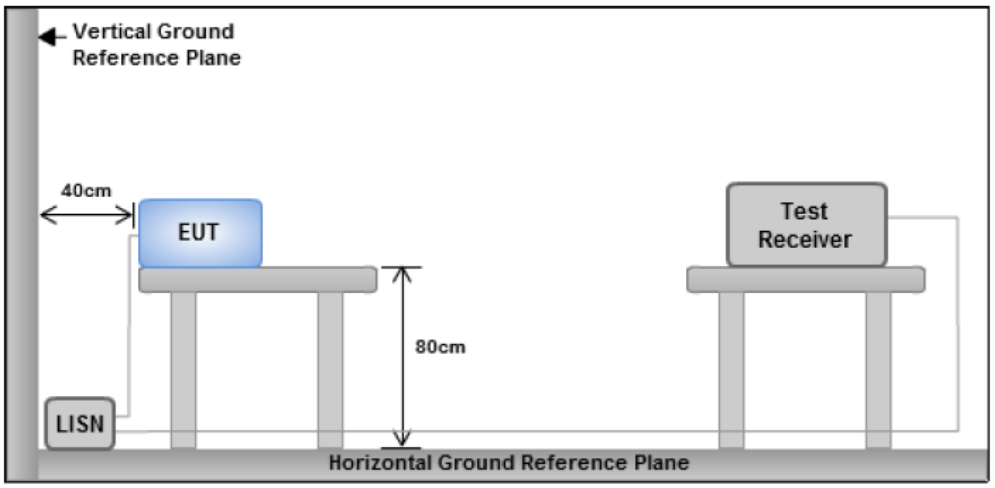
10.1 Antenna Requirement

Spec	Requirement	Applicable
§15.203	An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. Antenna requirement must meet at least one of the following: a) Antenna must be permanently attached to the device. b) The antenna must use a unique type of connector to attach to the device. c) Device must be professionally installed. The installer shall be responsible for ensuring that the correct antenna is employed by the device.	☒
Remark	The EUT uses an antenna that is permanently attached to the board which meets the requirement.	
Result	☒ PASS ☐ FAIL	

10.2 Conducted Emissions

Conducted Emission Limit

Frequency ranges (MHz)	Limit (dBuV)	
	QP	Average
0.15 ~ 0.5	66 – 56	56 – 46
0.5 ~ 5	56	46
5 ~ 30	60	50

Spec	Item	Requirement	Applicable
FCC 15.207 RSS-GEN Section 8.8	a)	For Low-power radio-frequency devices that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). The lower limit applies at the boundary between the frequency ranges.	☒
Test Setup	 Note: 1. Support units were connected to second LISN. 2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes		
Procedure	- The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table, as shown in Annex B. - The power supply for the EUT was fed through a 50Ω/50µH EUT LISN, connected to filtered mains. - The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable. - All other supporting equipment was powered separately from another main supply.		
Remark	EUT was tested at 120VAC, 60Hz		
Result	☒ Pass ☐ Fail		

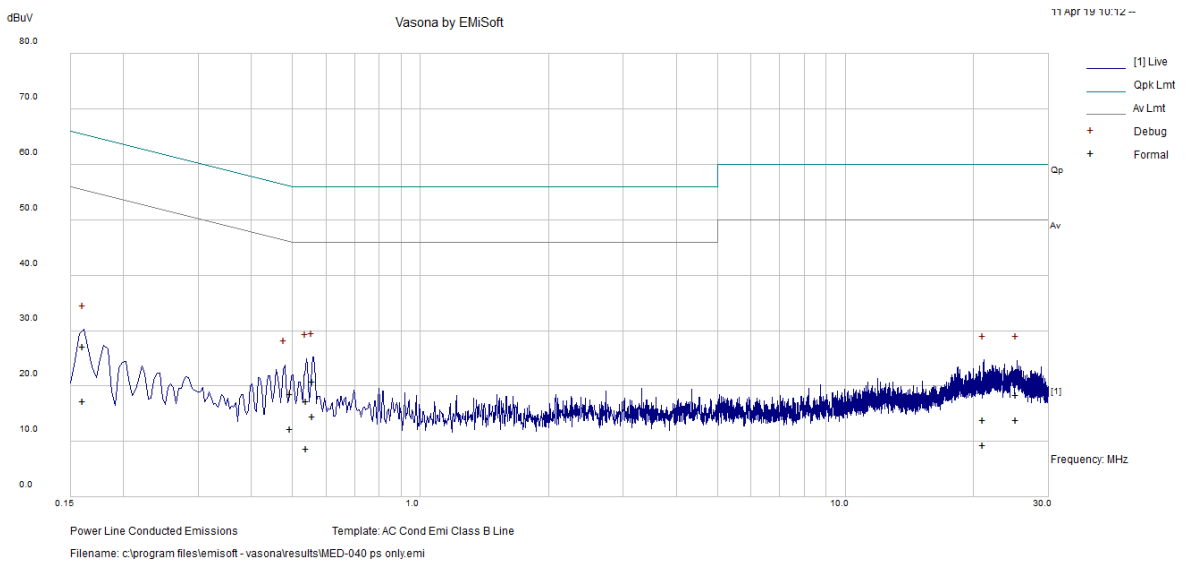
Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Cipher Chu at Conducted Emission test site.

Conducted Emission Test Results

Test specification:	Conducted Emissions			
Environmental Conditions:	Temp(°C):	21	Result:	☒ Pass ☐ Fail
	Humidity (%):	42		
	Atmospheric(mbar):	1021		
Mains Power:	120Vac, 60Hz			
Tested by:	Cipher Chu			
Test Date:	04/11/2018			
Remarks	Live			

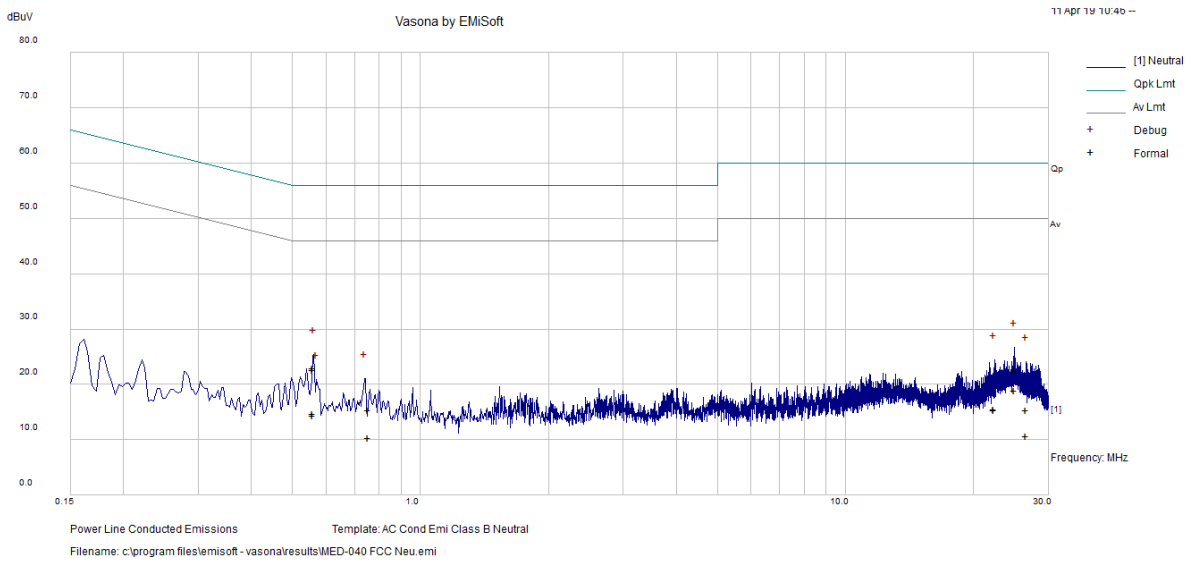


Live Plot at 120Vac, 60Hz

Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line / Neutral	Limit (dBuV)	Margin (dB)	Pass /Fail
0.46	34.99	9.33	0.04	44.36	Quasi Peak	Live	56.75	-12.39	Pass
0.29	38.19	9.32	0.04	47.56	Quasi Peak	Live	60.49	-12.93	Pass
0.15	41.7	9.33	0.05	51.08	Quasi Peak	Live	65.98	-14.9	Pass
1.20	33.32	9.33	0.05	42.7	Quasi Peak	Live	56	-13.3	Pass
0.37	35.91	9.33	0.04	45.28	Quasi Peak	Live	58.4	-13.12	Pass
1.28	31.09	9.34	0.05	40.47	Quasi Peak	Live	56	-15.53	Pass
0.46	34.29	9.33	0.04	43.66	Average	Live	46.75	-3.09	Pass
0.29	36.88	9.32	0.04	46.24	Average	Live	50.49	-4.25	Pass
0.15	38.03	9.33	0.05	47.41	Average	Live	55.98	-8.57	Pass
1.20	31.87	9.33	0.05	41.25	Average	Live	46	-4.75	Pass
0.37	35.57	9.33	0.04	44.93	Average	Live	48.4	-3.47	Pass
1.28	29.57	9.34	0.05	38.95	Average	Live	46	-7.05	Pass

Conducted Emission Test Results

Test specification:	Conducted Emissions			
Environmental Conditions:	Temp(°C):	21	Result:	☒ Pass ☐ Fail
	Humidity (%):	42		
	Atmospheric(mbar):	1021		
Mains Power:	120Vac, 60Hz			
Tested by:	Cipher Chu			
Test Date:	04/11/2018			
Remarks	Neutral			

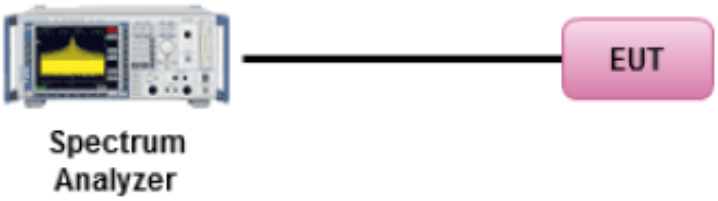


Neutral Plot at 120Vac, 60Hz

Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line / Neutral	Limit (dBuV)	Margin (dB)	Pass /Fail
0.56	15.44	7.4	0.03	22.88	Quasi Peak	Neutral	56	-33.12	Pass
25.06	12.71	9.03	0.67	22.41	Quasi Peak	Neutral	60	-37.59	Pass
0.76	7.7	7.55	0.04	15.29	Quasi Peak	Neutral	56	-40.71	Pass
0.56	15.21	7.4	0.03	22.64	Quasi Peak	Neutral	56	-33.36	Pass
22.43	6.02	9	0.55	15.57	Quasi Peak	Neutral	60	-44.43	Pass
26.67	5.56	9.03	0.74	15.33	Quasi Peak	Neutral	60	-44.67	Pass
0.56	7.33	7.4	0.03	14.76	Average	Neutral	46	-31.24	Pass
25.06	9.24	9.03	0.67	18.94	Average	Neutral	50	-31.06	Pass
0.76	2.74	7.55	0.04	10.33	Average	Neutral	46	-35.67	Pass
0.56	6.93	7.4	0.03	14.36	Average	Neutral	46	-31.64	Pass
22.43	5.78	9	0.55	15.34	Average	Neutral	50	-34.66	Pass
26.67	0.87	9.03	0.74	10.65	Average	Neutral	50	-39.35	Pass

10.3 6dB & 99% Bandwidth

Requirement(s):

Spec	Requirement			Applicable
§ 15.247	6dB BW≥500KHz;			☒
Test Setup				
Test Procedure	558074 D01 DTS Meas Guidance v05, 8.1 DTS bandwidth 6dB Emission bandwidth measurement procedure - Set RBW = 100 kHz. - Set the video bandwidth (VBW) ⩾ 3 x RBW. - Detector = Peak. - Trace mode = max hold. - Sweep = auto couple. - Allow the trace to stabilize. - Measure 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.			
Test Date	12/24/2018	Environmental condition	Temperature Relative Humidity Atmospheric Pressure	23°C 42% 1021mbar
Remark	N/A			
Result	☒ Pass ☐ Fail			

Test Data ☒ Yes ☐ N/A
Test Plot ☒ Yes ☐ N/A

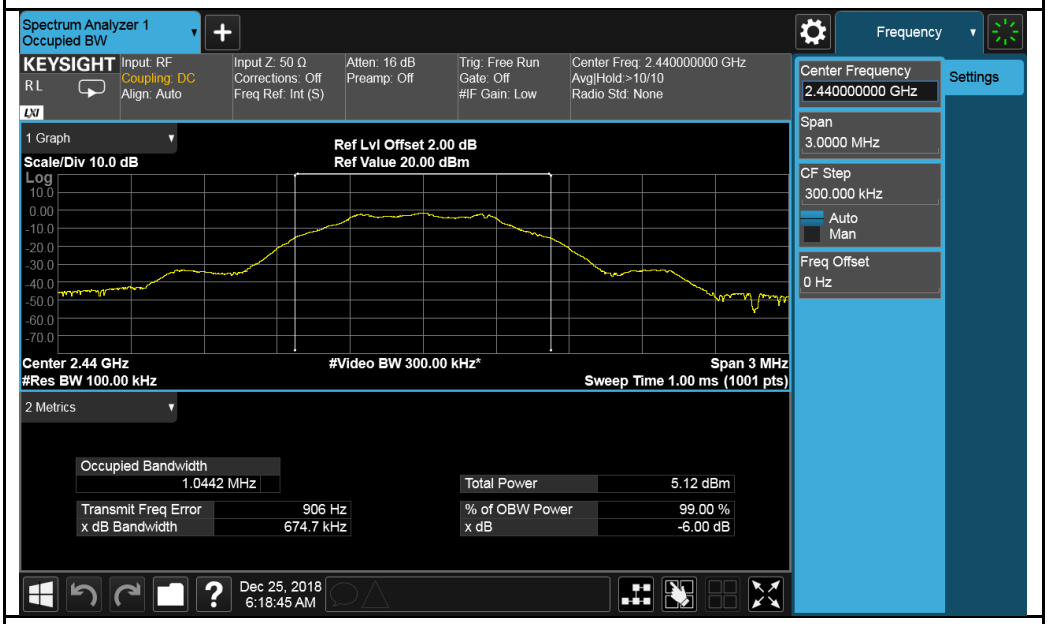
Test was done by Shuo Zhang at RF test site.

BLE:

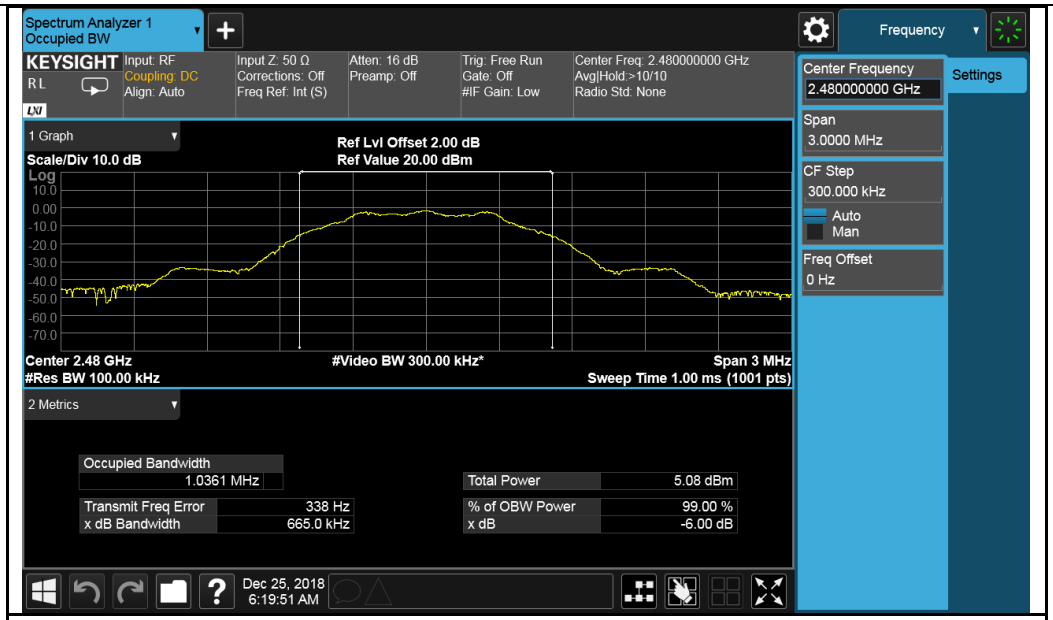
Channel	Channel Frequency (MHz)	OBW	
		99% (MHz)	6dB(KHz)
Low	2402	1.037	663.1
Mid	2440	1.044	674.7
High	2480	1.036	665.0

6dB & 99% Bandwidth Test Plots

BLE-2402MHz



BLE-2440MHz

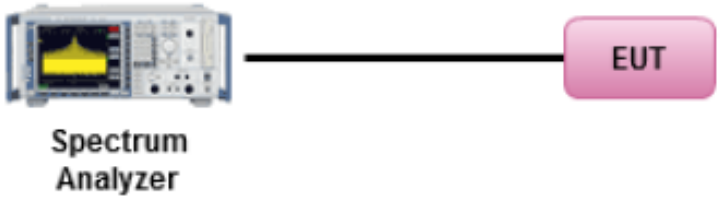

Spectrum Analyzer 1
Occupied BW
KEYSIGHT
Input: RF
Coupling: DC
Align: Auto
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
Atten: 16 dB
Preamp: Off
Trig: Free Run
Gate: Off
#IF Gain: Low
Center Freq: 2.480000000 GHz
Avg|Hold:>10/10
Radio Std: None
Frequency
Center Frequency
2.480000000 GHz
Settings
Span
3.0000 MHz
CF Step
300.000 kHz
Auto
Man
Freq Offset
0 Hz
1 Graph
Ref Lvl Offset 2.00 dB
Scale/Div 10.0 dB
Ref Value 20.00 dBm
Log
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Center 2.48 GHz
#Res BW 100.00 kHz
#Video BW 300.00 kHz*
Span 3 MHz
Sweep Time 1.00 ms (1001 pts)
2 Metrics
Occupied Bandwidth
1.0361 MHz
Total Power
5.08 dBm
Transmit Freq Error
338 Hz
% of OBW Power
99.00 %
x dB Bandwidth
665.0 kHz
x dB
-6.00 dB
Dec 25, 2018
6:19:51 AM

BLE-2480MHz

10.4 Output Power

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247	1	For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power.	☒

Test Setup				
Test Procedure	558074 D01 DTS Meas Guidance v05, 9.1.1 Measurement using a Spectrum Analyzer (SA) This procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the DTS bandwidth. (a) Set the RBW ⩾ DTS bandwidth. (b) Set VBW ⩾ 3 RBW. (c) Set span ⩾ 3 RBW (d) Sweep time = auto couple. (e) Detector = peak. (f) Trace mode = max hold. (g) Allow trace to fully stabilize (h) Use peak marker function to determine the peak amplitude level.			
Test Date	12/24/2018	Environmental condition	Temperature Relative Humidity Atmospheric Pressure	23°C 44% 1021mbar
Remark	NONE			
Result	☒ Pass ☐ Fail			

Test Data ☒ Yes ☐ N/A

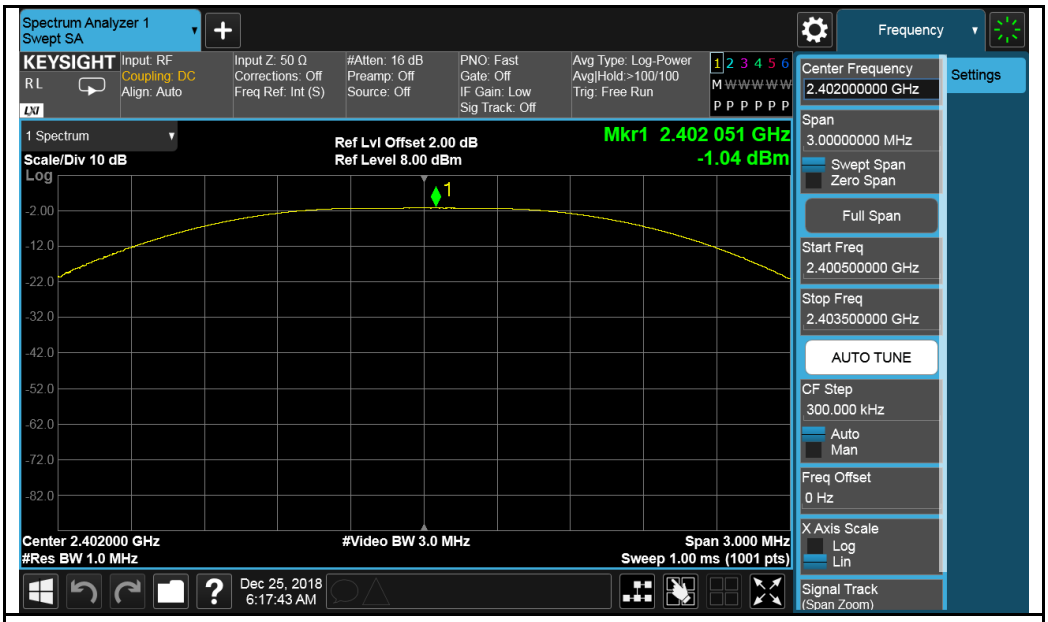
Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Shuo Zhang at RF test site.

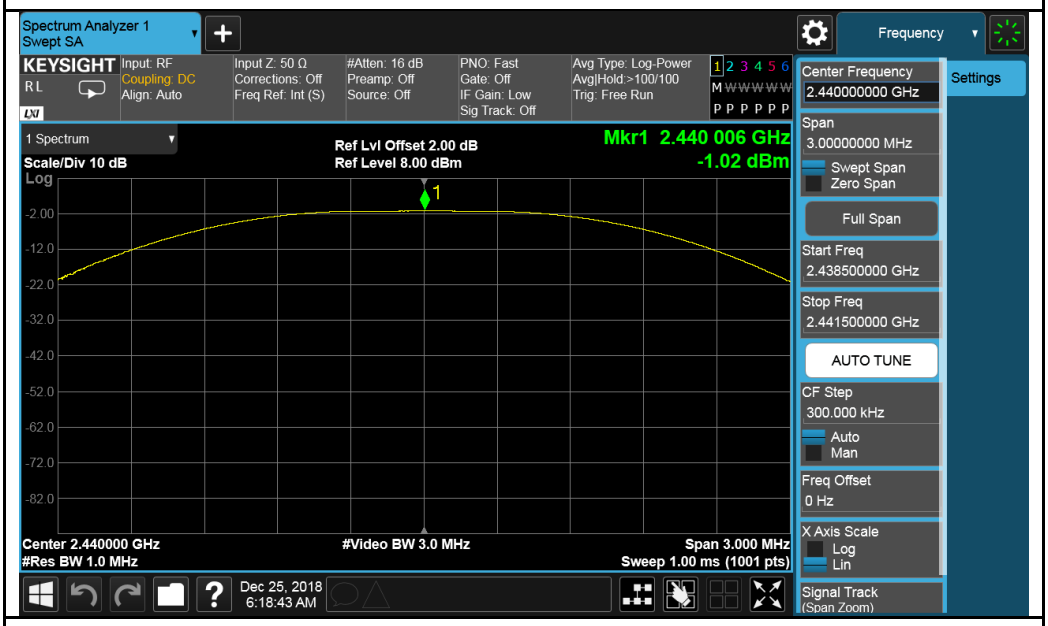
Output Power measurement results for BLE:

Type	Freq (MHz)	Test mode	CH	Conducted Power (dBm)	Limit (dBm)	Result
Output power	2402	Bluetooth LE	Low	-1.04	≤30	Pass
	2440	Bluetooth LE	Mid	-1.02	≤30	Pass
	2480	Bluetooth LE	High	-1.08	≤30	Pass

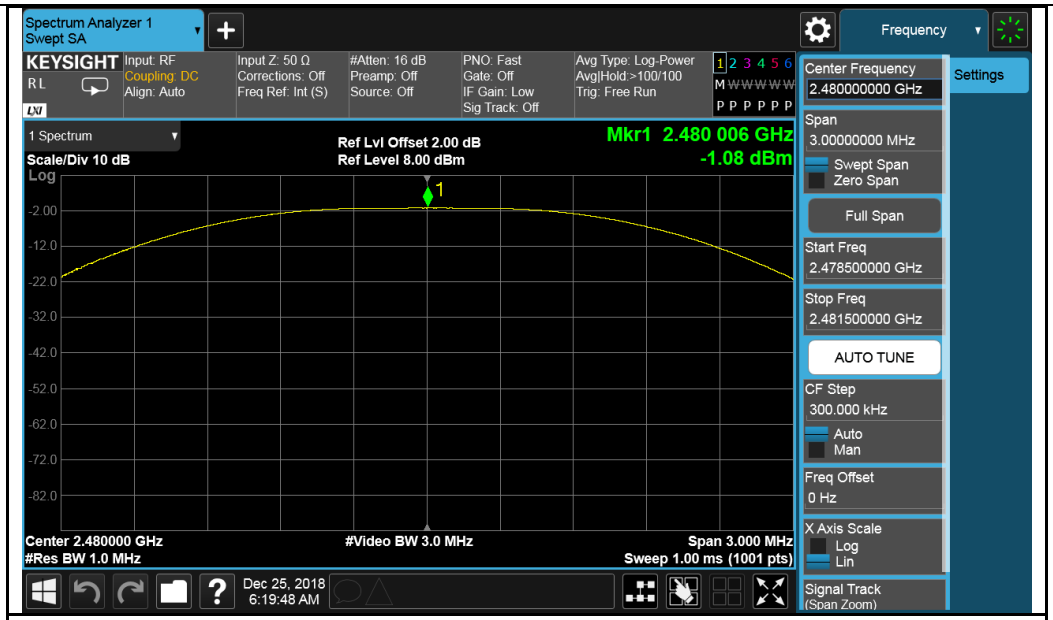
Test Plots:



BLE-2402MHz



BLE-2440MHz

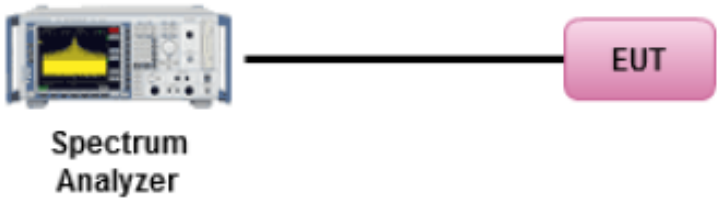

Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Auto
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
#Atten: 16 dB
Preamp: Off
Source: Off
PNO: Fast
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Avg|Hold:>100/100
Trig: Free Run
1 Spectrum
Scale/Div 10 dB
Log
Ref Lvl Offset 2.00 dB
Ref Level 8.00 dBm
Mkr1 2.480 006 GHz
-1.08 dBm
-2.00
-12.0
-22.0
-32.0
-42.0
-52.0
-62.0
-72.0
-82.0
Center 2.480000 GHz
#Res BW 1.0 MHz
#Video BW 3.0 MHz
Span 3.000 MHz
Sweep 1.00 ms (1001 pts)
Dec 25, 2018
6:19:48 AM
Frequency
Settings
Center Frequency
2.480000000 GHz
Span
3.00000000 MHz
Swept Span
Zero Span
Full Span
Start Freq
2.478500000 GHz
Stop Freq
2.481500000 GHz
AUTO TUNE
CF Step
300.000 kHz
Auto
Man
Freq Offset
0 Hz
X Axis Scale
Log
Lin
Signal Track
(Span Zoom)

BLE-2480MHz

10.5 Band Edge and Conducted Spurious emissions

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247	d)	For non-restricted band, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB or 30dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, determined by the measurement method on output power to be used. Attenuation below the general limits specified in § 15.209 (a) is not required ☐ 20 dB down ☒ 30 dB down	☒

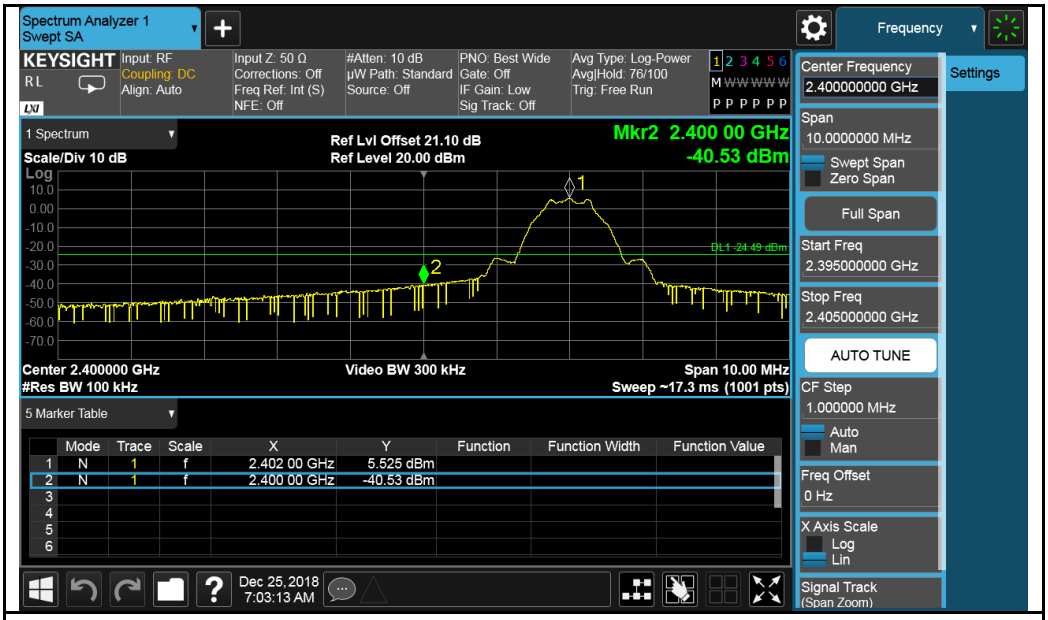
Test Setup				
Test Procedure	558074 D01 DTS Meas Guidance v05 Band Edge measurement procedure 1. Set the EUT to maximum power setting and enable the EUT transmit continuously. 2. Band edge emissions must be at least 30 dB down from the highest emission level within the authorized band as a measured. The attunation shall be be 30 dB instead of 20 dB when Peak conducted output power procedure is used. 3. Change modulation and channel bandwidth then repeat step 1 to 2. 4. Measured and record the results in the test report.			
Test Date	12/24/2018	Environmental condition	Temperature Relative Humidity Atmospheric Pressure	22°C 46% 1020mbar
Remark	-			
Result	☒ Pass ☐ Fail			

Test Data ☐ Yes ☒ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Shuo Zhang at RF test site.

Test Plots:

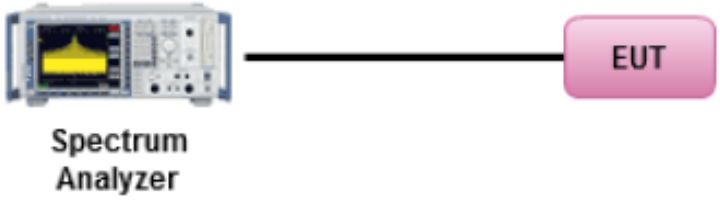


BLE-2402MHz

BLE-2480MHz

10.6 Peak Spectral Density

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247(e)	e)	DSSS: ≤8dBm/3KHz	☒
	f)	DSSS in hybrid sys with FH turned off: ≤8dBm/3KHz	☐
Test Setup			
Test Procedure	558074 D01 DTS Meas Guidance v05, 10.2 Method PKPSD (peak PSD) Peak spectral density measurement procedure - Set analyzer center frequency to DTS channel center frequency. - Set the span to 1.5 times the DTS bandwidth. - Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz. - Set the VBW ≥ 3 x RBW. - Detector = Peak - Sweep time = auto couple. - Trace mode = Max Hold - Allow trace to fully stabilize. - Use the peak marker function to determine the maximum amplitude level within the RBW. - If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.		
Test Date	12/24/2018	Environmental condition	Temperature 22°C Relative Humidity 46% Atmospheric Pressure 1020mbar
Remark	N/A		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes ☐ N/A

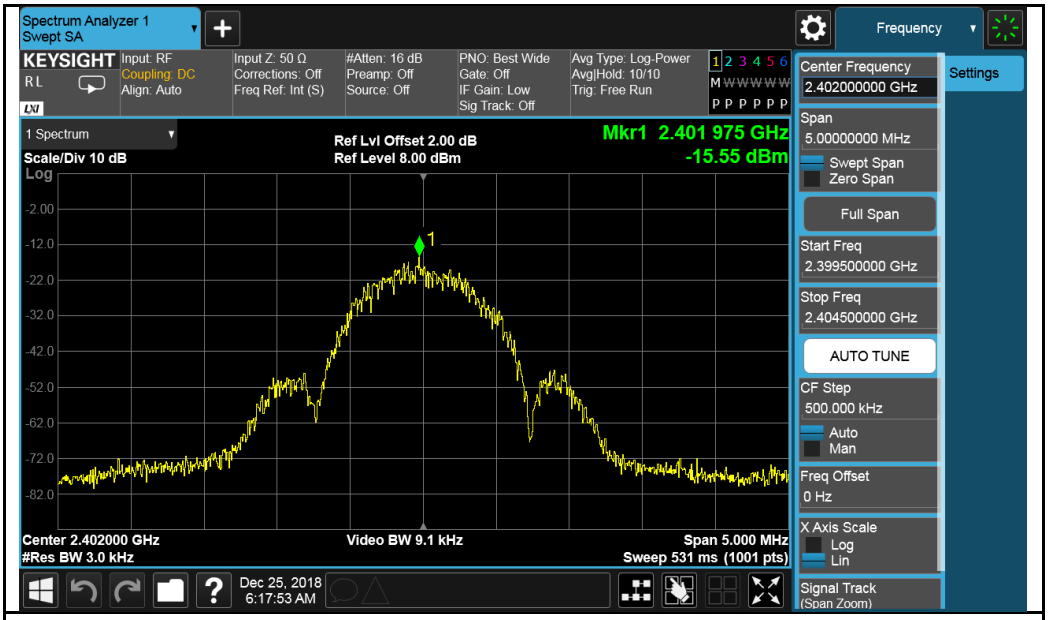
Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Shuo Zhang at RF test site.

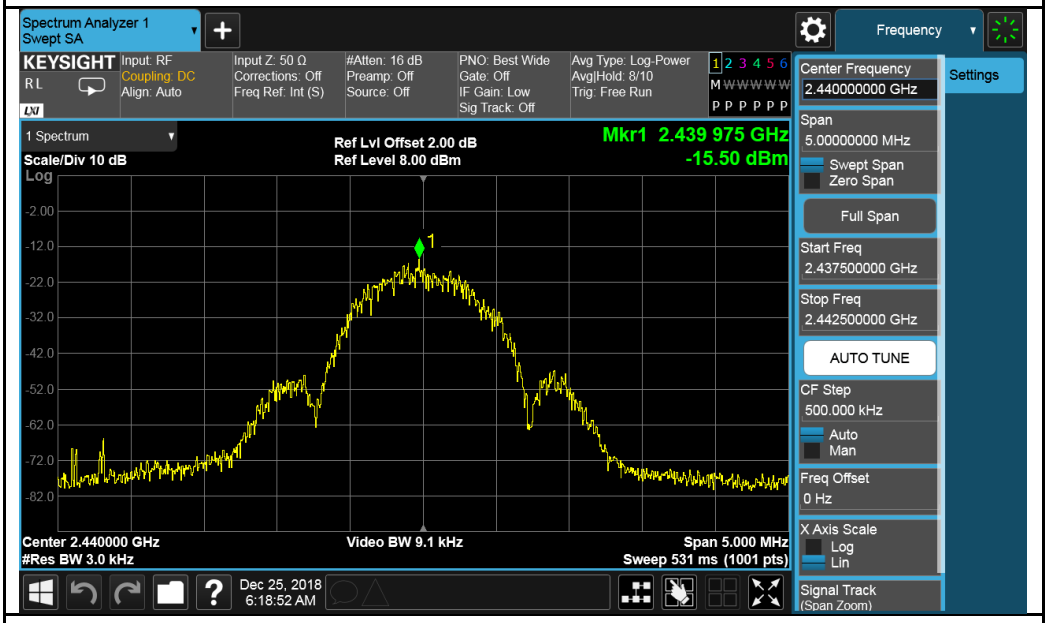
PSD measurement results for BLE:

Type	Freq (MHz)	Test mode	CH	Conducted PSD (dBm/3KHz)	Limit (dBm/3KHz)	Result
PSD	2402	Bluetooth LE	Low	-15.55	8	Pass
	2440	Bluetooth LE	Mid	-15.50	8	Pass
	2480	Bluetooth LE	High	-15.83	8	Pass

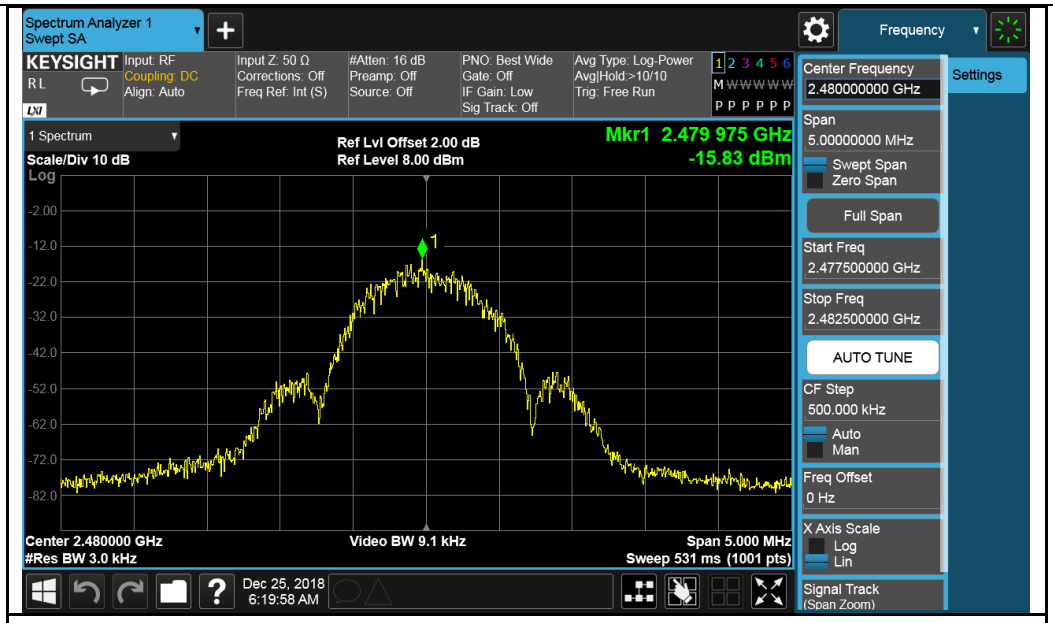
Test Plots



BLE-2402MHz



BLE-2440MHz


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Auto
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
#Atten: 16 dB
Preamp: Off
Source: Off
PNO: Best Wide
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Avg|Hold:>10/10
Trig: Free Run
1 Spectrum
Scale/Div 10 dB
Log
Ref Lvl Offset 2.00 dB
Ref Level 8.00 dBm
Mkr1 2.479 975 GHz
-15.83 dBm
-2.00
-12.0
-22.0
-32.0
-42.0
-52.0
-62.0
-72.0
-82.0
Center 2.480000 GHz
#Res BW 3.0 kHz
Video BW 9.1 kHz
Span 5.000 MHz
Sweep 531 ms (1001 pts)
Dec 25, 2018
6:19:58 AM
Frequency
Settings
Center Frequency
2.480000000 GHz
Span
5.00000000 MHz
Swept Span
Zero Span
Full Span
Start Freq
2.477500000 GHz
Stop Freq
2.482500000 GHz
AUTO TUNE
CF Step
500.000 kHz
Auto
Man
Freq Offset
0 Hz
X Axis Scale
Log
Lin
Signal Track
(Span Zoom)

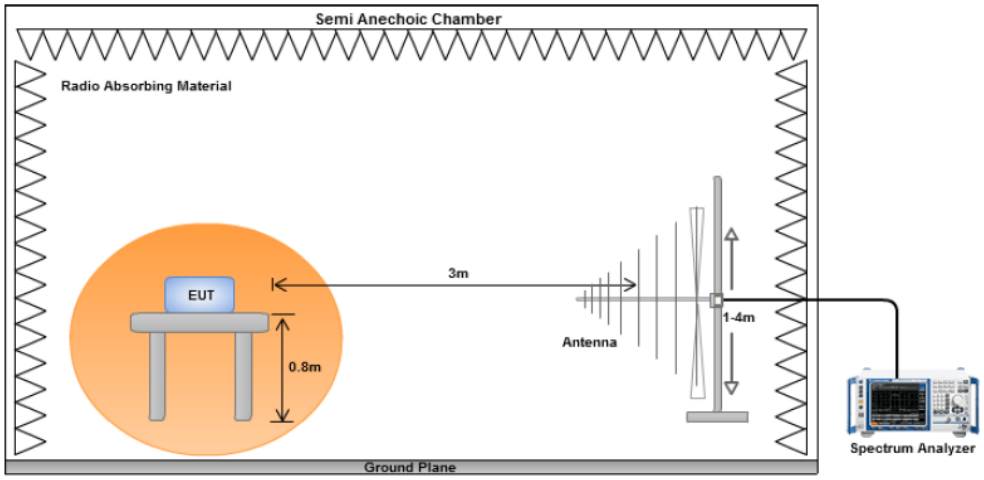
BLE-2480MHz

10.7 Radiated Spurious Emissions below 1GHz

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR§15.247(d)	a)	Except higher limit as specified elsewhere in other section, the emissions from the low-power radio-frequency devices shall not exceed the field strength levels specified in the following table and the level of any unwanted emissions shall not exceed the level of the fundamental emission. The tighter limit applies at the band edges	☒

Frequency range (MHz)	Field Strength (uV/m)
30 – 88	100
88 – 216	150
216 960	200
Above 960	500

Test Setup	
Procedure	1. The EUT was switched on and allowed to warm up to its normal operating condition. 2. The test was carried out at the selected frequency points obtained from the EUT characterisation. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner: a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen. b. The EUT was then rotated to the direction that gave the maximum emission. c. Finally, the antenna height was adjusted to the height that gave the maximum emission. 3. A Quasi-peak measurement was then made for that frequency point. 4. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.
Remark	The EUT was scanned up to 1GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case. The EUT was evaluated in each of three orthogonal axis positions, the orientation is the worst case, please refer to setup photos.
Result	☒ Pass ☐ Fail

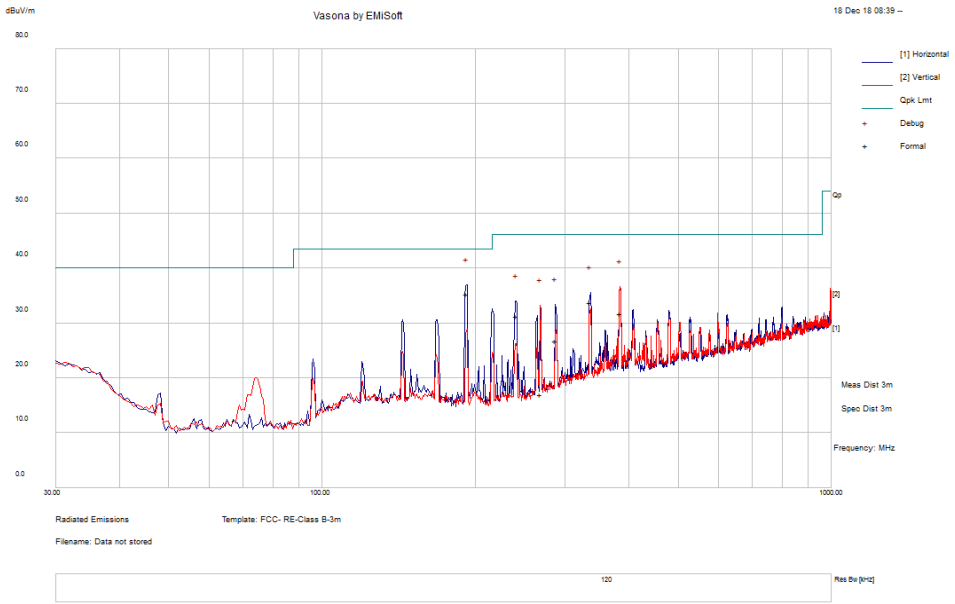
Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Shuo Zhang at 10m chamber.

Radiated Emission Test Results (Below 1GHz)

Test specification	below 1GHz			
Environmental Conditions:	Temp (°C):	26	Result	Pass
	Humidity (%)	47		
	Atmospheric (mbar):	1020		
Mains Power:	120VAC, 60Hz			
Tested by:	Shuo Zhang			
Test Date:	12/17/2018			
Remarks:	Worst case below 1G			

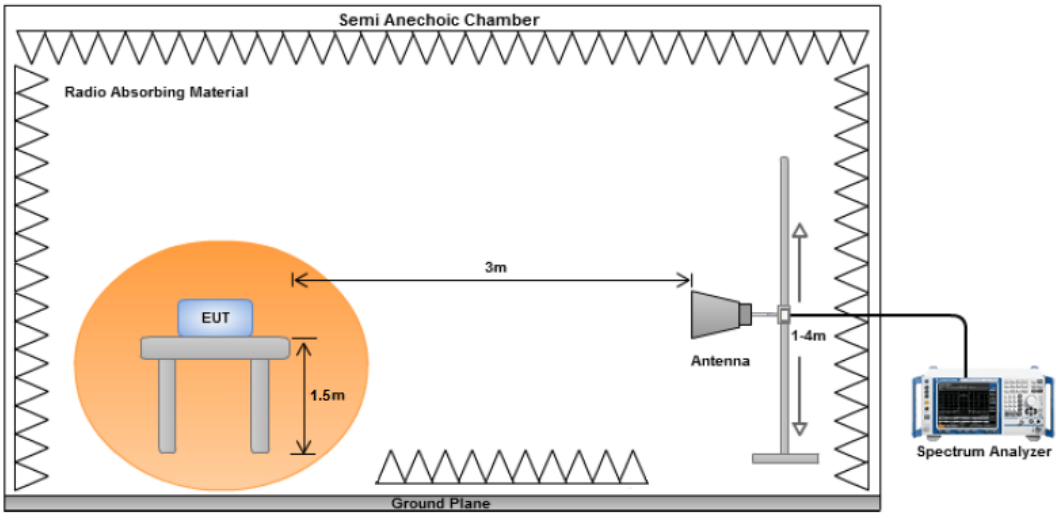


Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
192.23	47.62	12.54	-24.89	35.28	Quasi Max	H	104	335	43.5	-8.22	Pass
384.78	38.1	13.67	-20.08	31.69	Quasi Max	V	143	289	46	-14.31	Pass
336.01	41.37	13.48	-21.12	33.74	Quasi Max	H	108	196	46	-12.27	Pass
240.54	42.77	12.89	-24.33	31.32	Quasi Max	H	116	116	46	-14.68	Pass
287.04	35.59	13.22	-22.03	26.79	Quasi Max	H	106	168	46	-19.21	Pass
268.21	27.11	13.08	-23.23	16.95	Quasi Max	H	305	243	46	-29.05	Pass

Note: Both horizontal and vertical polarities were investigated. The results above show only the worst case.

10.8 Radiated Spurious Emissions between 1GHz – 25GHz

Requirement(s):

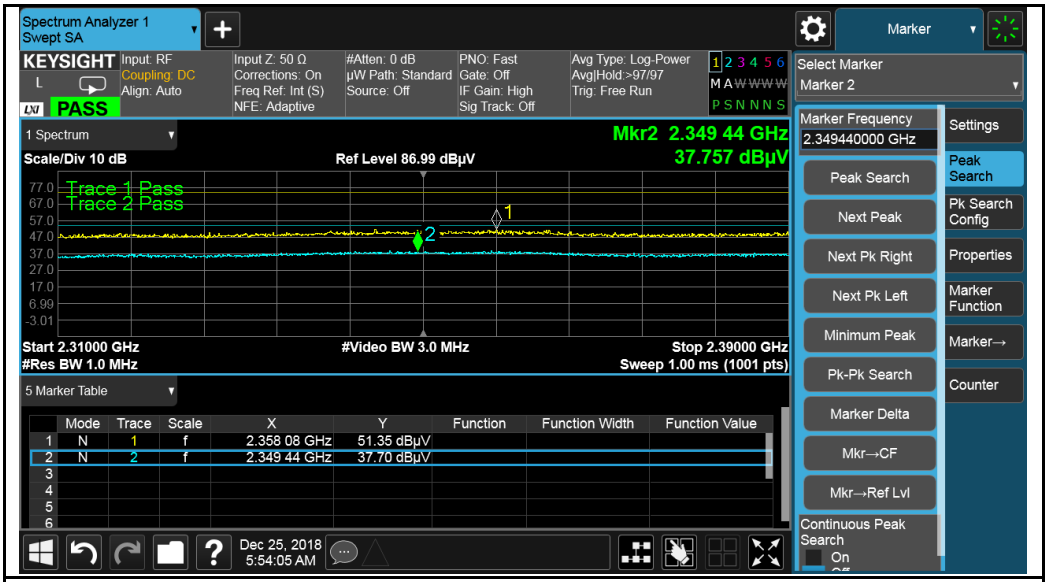
Spec	Item	Requirement	Applicable
47CFR§15.247(d)	a)	For non-restricted band, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB or 30dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, determined by the measurement method on output power to be used. Attenuation below the general limits specified in § 15.209(a) is not required ☐ 20 dB down ☒ 30 dB down	☒
Test Setup			
Procedure		1. The EUT was switched on and allowed to warm up to its normal operating condition. 2. The test was carried out at the selected frequency points obtained from the EUT characterisation. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner: a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen. b. The EUT was then rotated to the direction that gave the maximum emission. c. Finally, the antenna height was adjusted to the height that gave the maximum emission. 3. An average measurement was then made for that frequency point. 4. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.	
Remark		The EUT was scanned up to 40GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case. There isn't outstanding emission found at the edge of restricted frequency. The EUT was evaluated in each of three orthogonal axis positions, the orientation is the worst case, please refer to setup photos.	
Result		☒ Pass ☐ Fail	

Test Data ☒ Yes (See below) ☐ N/A

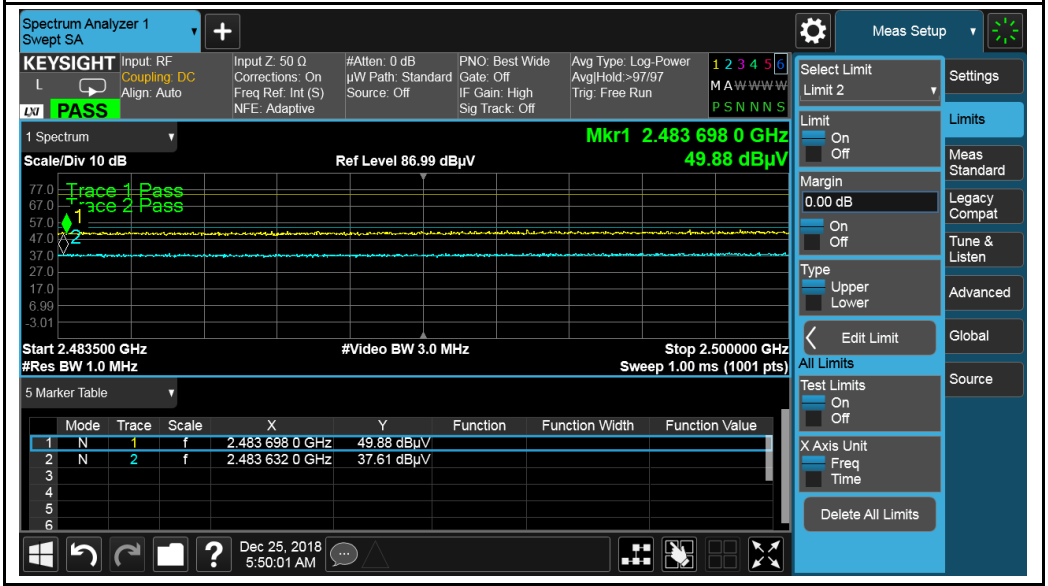
Test Plot ☐ Yes (See below) ☒ N/A

Test was done by Shuo Zhang at 10m chamber.

Restricted Band Measurement Plots:



BLE-2402MHz



BLE-2480MHz Peak

Radiated Emission Test Results (Above 1GHz)

Above 1GHz-25GHz- BLE - 2402MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
7206.74	45.51	5.15	-0.45	50.2	Peak Max	V	236	207	74	-23.8	Pass
4581.69	40.48	4.18	-1.04	43.62	Peak Max	V	170	136	74	-30.38	Pass
3912.87	40.73	3.76	-0.49	44	Peak Max	V	129	79	74	-30	Pass
7206.74	31.95	5.15	-0.45	36.65	Average Max	V	236	207	54	-17.36	Pass
4581.69	27.61	4.18	-1.04	30.75	Average Max	V	170	136	54	-23.25	Pass
3912.87	27.99	3.76	-0.49	31.25	Average Max	V	129	79	54	-22.75	Pass

Above 1GHz-25GHz- BLE - 2440MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
7320.46	42.83	5.15	-0.49	47.49	Peak Max	V	173	315	74	-26.51	Pass
7532.33	40.06	5.14	-0.57	44.64	Peak Max	V	114	206	74	-29.36	Pass
3980.07	40.87	3.83	-0.35	44.35	Peak Max	V	176	352	74	-29.65	Pass
7320.46	29.2	5.15	-0.49	33.86	Average Max	V	173	315	54	-20.14	Pass
7532.33	27.21	5.14	-0.57	31.78	Average Max	V	114	206	54	-22.22	Pass
3980.07	27.85	3.83	-0.35	31.33	Average Max	V	176	352	54	-22.67	Pass

Above 1GHz-25GHz- BLE - 2480MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
6579.46	40.8	4.89	-0.25	45.44	Peak Max	V	239	104	74	-28.56	Pass
3901.24	40.95	3.74	-0.51	44.19	Peak Max	V	205	348	74	-29.81	Pass
4124.10	41.45	3.9	-0.65	44.7	Peak Max	V	142	232	74	-29.3	Pass
6579.46	26.96	4.89	-0.25	31.6	Average Max	V	239	104	54	-22.4	Pass
3901.24	27.95	3.74	-0.51	31.18	Average Max	V	205	348	54	-22.82	Pass
4124.10	27.56	3.9	-0.65	30.81	Average Max	V	142	232	54	-23.19	Pass

Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Cycle	Cal Due	In use
Conducted Emissions						
R & S Receiver	ESIB 40	100179	06/08/2018	1 Year	06/08/2019	☑
CHASE LISN	MN2050B	1018	04/07/2018	1 Year	04/07/2019	☑
Radiated Emissions						
Spectrum Analyzer	N9010A	10SL0219	08/20/2018	1 Year	08/20/2019	☑
Bi-Log antenna (30MHz~2GHz)	JB1	A030702	08/12/2018	1 Year	08/12/2019	☑
Horn Antenna (1GHz~26GHz)	3115	100059	08/25/2018	1 Year	08/25/2019	☑
Horn Antenna (26GHz~40GHz)	AH-840	101013	08/28/2018	1 Year	08/28/2019	☑
Pre-Amp (30MHz~40GHz)	LPA-6-30	11140711	02/10/2018	1 Year	02/10/2019	☑
RF Conducted Measurement						
Spectrum Analyzer	N9010A	10SL0219	08/20/2018	1 Year	08/20/2019	☑

Annex B. SIEMIC Accreditation

Accreditations	Document	Scope / Remark
ISO 17025 (A2LA)		Please see the documents for the detailed scope
ISO Guide 65 (A2LA)		Please see the documents for the detailed scope
TCB Designation		A1, A2, A3, A4, B1, B2, B3, B4, C
FCC DoC Accreditation		FCC Declaration of Conformity Accreditation
FCC Site Registration		3 meter site
FCC Site Registration		10 meter site
IC Site Registration		3 meter site
IC Site Registration		10 meter site
EU NB		**Radio & Telecommunications Terminal Equipment:** EN45001 – EN ISO/IEC 17025
		Electromagnetic Compatibility: EN45001 – EN ISO/IEC 17025
Singapore iDA CB(Certification Body)		Phase I, Phase II
Vietnam MIC CAB Accreditation		Please see the document for the detailed scope
Hong Kong OFCA		**(Phase II)** OFCA Foreign Certification Body for Radio and Telecom
		(Phase I) Conformity Assessment Body for Radio and Telecom
Industry Canada CAB		**Radio:** Scope A – All Radio Standard Specification in Category I
		Telecom: CS-03 Part I, II, V, VI, VII, VIII

Japan Recognized Certification Body Designation		**Radio**: A1. Terminal equipment for purpose of calling **Telecom**: B1. Specified radio equipment specified in Article 38-2, Paragraph 1, Item 1 of the Radio Law
Korea CAB Accreditation		**EMI:** KCC Notice 2008-39, RRL Notice 2008-3: CA Procedures for EMI KN22: Test Method for EMI **EMS:** KCC Notice 2008-38, RRL Notice 2008-4: CA Procedures for EMS KN24, KN61000-4-2, -4-3, -4-4, -4-5, -4-6, -4-8, -4-11: Test Method for EMS
		Radio: RRL Notice 2008-26, RRL Notice 2008-2, RRL Notice 2008-10, RRL Notice 2007-49, RRL Notice 2007-20, RRL Notice 2007-21, RRL Notice 2007-80, RRL Notice 2004-68
		Telecom: President Notice 20664, RRL Notice 2007-30, RRL Notice 2008-7 with attachments 1, 3, 5, 6; President Notice 20664, RRL Notice 2008-7 with attachment 4
Taiwan NCC CAB Recognition		LP0002, PSTN01, ADSL01, ID0002, IS6100, CNS14336, PLMN07, PLMN01, PLMN08
Taiwan BSMI CAB Recognition		CNS 13438
Japan VCCI		R-3083: Radiation 3 meter site C-3421: Main Ports Conducted Interference Measurement T-1597: Telecommunication Ports Conducted Interference Measurement
Australia CAB Recognition		**EMC:** AS/NZS CISPR 11, AS/NZS CISPR 14.1, AS/NZS CISPR22, AS/NZS 61000.6.3, AS/NZS 61000.6.4
		Radio communications: AS/NZS 4281, AS/NZS 4268, AS/NZS 4280.1, AS/NZS 4280.2, AS/NZS 4295, AS/NZS 4582, AS/NZS 4583, AS/NZS 4769.1, AS/NZS 4769.2, AS/NZS 4770, AS/NZS 4771
		Telecommunications: AS/ACIF S002:05, AS/ACIF S003:06, AS/ACIF S004:06 AS/ACIF S006:01, AS/ACIF S016:01, AS/ACIF S031:01, AS/ACIF S038:01, AS/ACIF S040:01, AS/ACIF S041:05, AS/ACIF S043.2:06, AS/ACIF S60950.1
Australia NATA Recognition		AS/ACIF S002, AS/ACIF S003, AS/ACIF S004, AS/ACIF S006, AS/ACIF S016,AS/ACIF S031, AS/ACIF S038, AS/ACIF S040, AS/ACIF S041, AS/ACIF S043.2