3 REFERENCES

Publication	Edition	Date	AMD 1
eCFR	-	2023	-
RSS-247	3	2023	-
RSS-GEN	5	2018	2019
ANSI C63.10	-	2013	-
KDB 178919 D01	6	2015	-
RSS-102	5	2015	2021
KDB 447498	-	2015	-

4 UNCERTAINTY SUMMARY

Using the guidance of the following publications the calculated measurement uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level, using a coverage factor of k = 2.

References
CISPR 16-4-1
CISPR 16-4-2
CISPR 32
ANSI C63.23
A2LA P103
A2LA P103c
ETSI TR 100-028

Measurement Type	Configuration	Uncertainty ±
Radiated Emissions	Biconical Antenna	5.0 dB
Radiated Emissions	Log Periodic Antenna	5.3 dB
Radiated Emissions	Horn Antenna	4.7 dB
AC Line Conducted Emissions	Artificial Mains Network	3.4 dB
Telecom Conducted Emissions	Asymmetric Artificial Network	4.9 dB
Disturbance Power Emissions	Absorbing Clamp	4.1 dB
Radiated Immunity	3 Volts/meter	2.2 dB
Conducted Immunity	CDN/EM/BCI	2.4/3.5/3.4 dB
EFT Burst/Surge	Peak pulse voltage	164 volts
ESD Immunity	15 kV level	1377 Volts

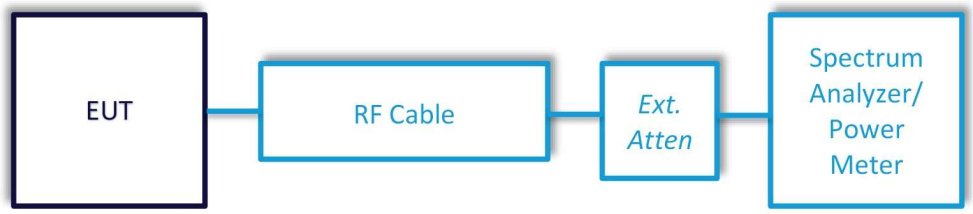
Parameter	ETSI U.C. ±	U.C. ±
Radio Frequency, from F0	$1x10^{-7}$	$0.55x10^{-7}$
Occupied Channel Bandwidth	5 %	2 %
RF conducted Power (Power Meter)	1.5 dB	1.2 dB
RF conducted emissions (Spectrum Analyzer)	3.0 dB	1.7 dB
All emissions, radiated	6.0 dB	5.3 dB
Temperature	1° C	0.65° C
Humidity	5 %	2.9 %
Supply voltages	3 %	1 %

5 TEST DATA

5.1 Antenna Port Conducted Emissions

Description of Measurement	The direct measurement of emissions at the antenna port of the EUT is achieved by use of a RF connection to a spectrum analyzer or power meter. The cable and attenuator factors are loaded into the analyzer or power meter allowing for direct measurement readings without the need for further corrections.
Example Calculations	Measurement (dBm) + Cable factor (dB) + External Attenuator (dB) = Corrected Reading (dBm) Margin (dB) = Limit (dBm) – Corrected Reading (dBm)

Block Diagram



5.1.1 Antenna Port Conducted Emissions – RF Output Power - Zigbee

Operator	Anthony Smith	**QA**	Adam Alger
Temperature	20.7°C	**R.H. %**	29.4%
Test Date	3/9/2023	**Location**	Conducted RF Bench
Requirement	FCC 15.247 RSS-247	**Method**	ANSI C63.10

Limits: <30dBm

Test Parameters

Frequency	2400-2483.5 MHz	**Setup**	Conducted
RBW	3 MHz	**VBW**	50 MHz
Detector(s)	Peak	**Settings**	Trace Max Hold

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960173	Cable	A.H. Systems, Inc.	SAC-26G-1	388	6/13/2023	6/12/2024	Active Verification
EE 960087	Analyzer - Spectrum	Agilent	N9010A	MY53400296	4/11/2023	4/11/2024	Active Calibration

EUT Parameters

Input Power	12VDC	**Mode**	802.15.4 250kbit
Frequency	2405, 2440, 2475, 2480 MHz	**Channel**	11, 18, 25, 26
Notes	Power Index: 7 for channels 11, 18, and 25; -8 for channel 26		

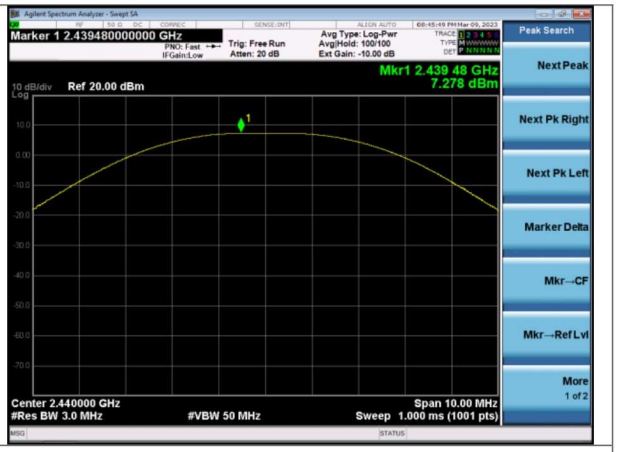
Data

Table

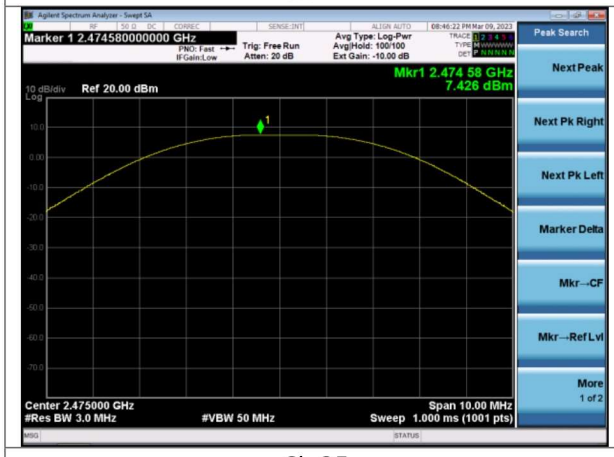
Channel	Mode	Peak Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Transmit Power Setting
11	Zigbee	7.1	30.0	22.9	7
18	Zigbee	7.3	30.0	22.7	7
25	Zigbee	7.4	30.0	22.6	7
26	Zigbee	-7.4	30.0	37.4	-8

Plots

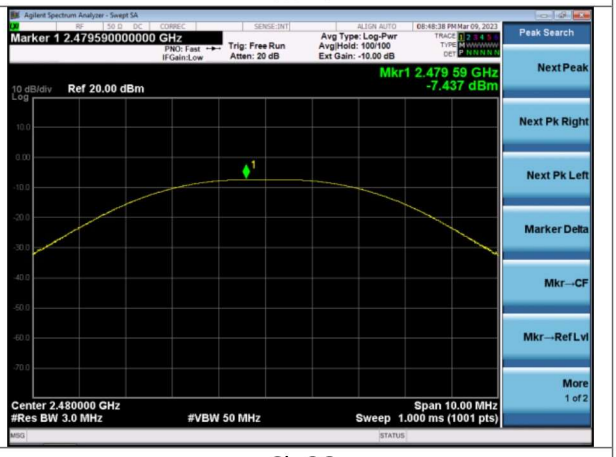
Ch 11



Ch 18



Ch 25



Ch 26

5.1.2 Antenna Port Conducted Emissions – RF Output Power - BLE

Operator	Anthony Smith	**QA**	Adam Alger
Temperature	20.7°C	**R.H. %**	29.4%
Test Date	3/9/2023	**Location**	Conducted RF Bench
Requirement	FCC 15.247 RSS-247	**Method**	ANSI C63.10

Limits: <30dBm

Test Parameters

Frequency	2400-2483.5 MHz	**Setup**	Conducted
RBW	3 MHz	**VBW**	50 MHz
Detector(s)	Peak	**Settings**	Trace Max Hold

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960173	Cable	A.H. Systems, Inc.	SAC-26G-1	388	6/13/2023	6/12/2024	Active Verification
EE 960087	Analyzer - Spectrum	Agilent	N9010A	MY53400296	4/11/2023	4/11/2024	Active Calibration

EUT Parameters

Input Power	12VDC	**Mode**	BLE – 125k, 500k, 1M, 2M
Frequency (MHz)	2402, 2440, 2480	**Channel**	37, 17, 39
Transmit Power Setting	7		

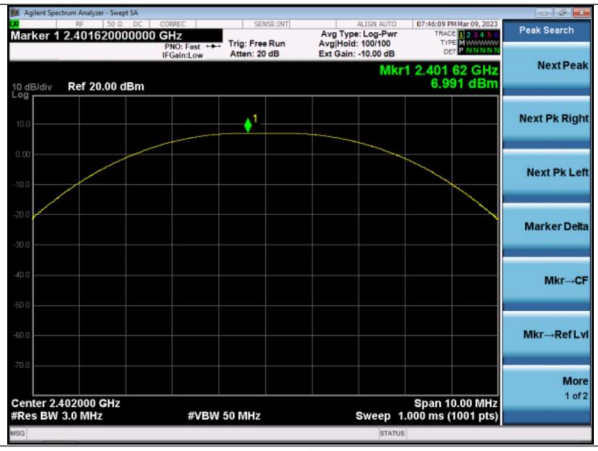
Data

Table

Channel	Mode	Peak Conducted Power (dBm)	Limit (dBm)	Margin (dB)
37	1M	7.1	30.0	22.9
17	1M	7.2	30.0	22.8
39	1M	7.4	30.0	22.6
37	2M	7.0	30.0	23.0
17	2M	7.2	30.0	22.8
39	2M	7.4	30.0	22.6
37	125k	7.0	30.0	23.0
17	125k	7.2	30.0	22.8
39	125k	7.4	30.0	22.6
37	500k	7.0	30.0	23.0
17	500k	7.2	30.0	22.8
39	500k	7.4	30.0	22.6

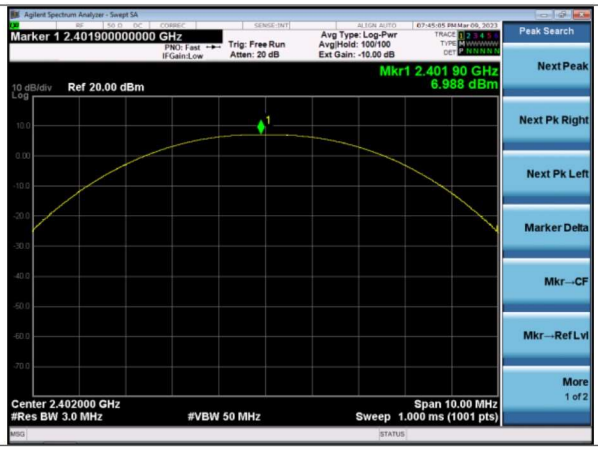
Plots

1M Ch 37



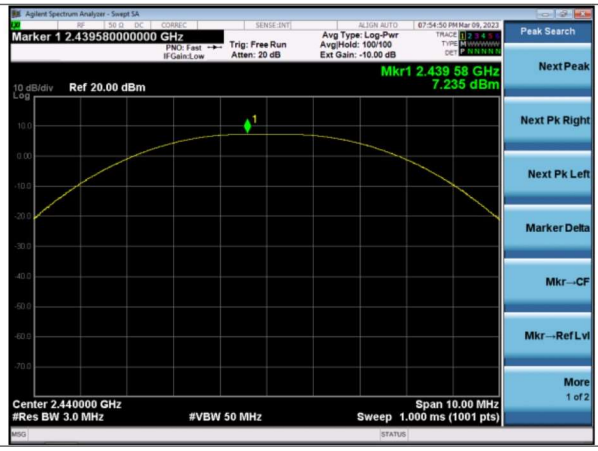
2M Ch 37

125k Ch 37



500k Ch 37

1M Ch 17



2M Ch 17