

SPURIOUS RADIATED EMISSIONS

TEST DESCRIPTION

The highest gain antenna of each type to be used with the EUT was tested. The EUT was configured for the required transmit frequencies and the modes as showed in the data sheets.

For each configuration, the spectrum was scanned throughout the specified range as part of the exploratory investigation of the emissions. These “pre-scans” are not included in the report. Final measurements on individual emissions were then made and included in this test report.

The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis if required, and adjusting the measurement antenna height and polarization (per ANSI C63.10). A preamp and high pass filter (and notch filter) were used for this test in order to provide sufficient measurement sensitivity.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector
PK = Peak Detector
AV = RMS Detector

Measurements were made to satisfy the specific requirements of the test specification for out of band emissions as well as the restricted band requirements.

If there are no detectable emissions above the noise floor, the data included may show noise floor measurements for reference only.

Where the radio test software does not provide for a duty cycle at continuous transmit conditions (> 98%) and the RMS (power average) measurements were made across the on and off times of the EUT transmissions, a duty cycle correction is added to the measurements using the formula of $10 \cdot \log(1/dc)$.

The duty cycle correction factor for each data rate is:

Data Rate	Duty Cycle (decimal)	Calculation	Factor (dB)
125 kbps	0.975	$10 \cdot \log (1 / 0.975)$	0.1
500 kbps	0.915	$10 \cdot \log (1 / 0.915)$	0.4
1 Mbps	0.861	$10 \cdot \log (1 / 0.861)$	0.7
2 Mbps	0.582	$10 \cdot \log (1 / 0.582)$	2.4

SPURIOUS RADIATED EMISSIONS

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFE	2023-04-18	2024-04-18
Antenna - Biconilog	Teseq	CBL 6141B	AXR	2022-11-01	2024-11-01
Antenna - Double Ridge	ETS Lindgren	3115	AIZ	2022-03-02	2024-03-02
Antenna - Standard Gain	ETS Lindgren	3160-07	AHU	NCR	NCR
Antenna - Standard Gain	ETS Lindgren	3160-08	AHV	NCR	NCR
Antenna - Standard Gain	ETS Lindgren	3160-09	AIV	NCR	NCR
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AOL	2022-11-03	2023-11-03
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	PAG	2023-03-26	2024-03-26
Amplifier - Pre-Amplifier	L-3 Narda-MITEQ	AMF-6F-08001200-30-10P	PAO	2022-11-03	2023-11-03
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVD	2022-11-03	2023-11-03
Amplifier - Pre-Amplifier	Miteq	AMF-6F-18002650-25-10P	AVU	2023-07-10	2024-07-10
Cable	N/A	Bilog Cables	EVA	2022-11-03	2023-11-03
Cable	N/A	Double Ridge Horn Cables	EVB	2023-03-26	2024-03-26
Cable	None	Standard Gain Horn Cables	EVF	2022-11-03	2023-11-03
Cable	ESM Cable Corp.	TTBJ141-KMKM-72	EVY	2023-07-10	2024-07-10
Attenuator	Coaxicom	3910-10	AWX	2023-02-10	2024-02-10
Filter - Low Pass	Micro-Tronics	LPM50004	LFD	2023-02-10	2024-02-10
Filter - High Pass	Micro-Tronics	HPM50111	HFO	2022-11-03	2023-11-03

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	5.2 dB	-5.2 dB

FREQUENCY RANGE INVESTIGATED

30 MHz TO 26400 MHz

POWER INVESTIGATED

12 VDC via 110VAC/60Hz

CONFIGURATIONS INVESTIGATED

PAYR0024-1

PAYR0024-2

MODES INVESTIGATED

Continuous Tx, BLE, 125 kbps, Low Ch = 2402 MHz, Mid Ch = 2442 MHz, High Ch = 2480 MHz

SPURIOUS RADIATED EMISSIONS

EUT:	BluKey Plus™ S (BK+S)	Work Order:	PAYR0024
Serial Number:	B	Date:	2023-10-06
Customer:	PayRange Inc.	Temperature:	21.8°C
Attendees:	Mike Mitchell	Relative Humidity:	52.1%
Customer Project:	None	Bar. Pressure (PMSL):	1020 mb
Tested By:	Jeff Alcock and Chris Ladwig	Job Site:	EV01
Power:	12 VDC via 110VAC/60Hz	Configuration:	PAYR0024-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 3:2023	ANSI C63.10:2013
RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	17	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)
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COMMENTS

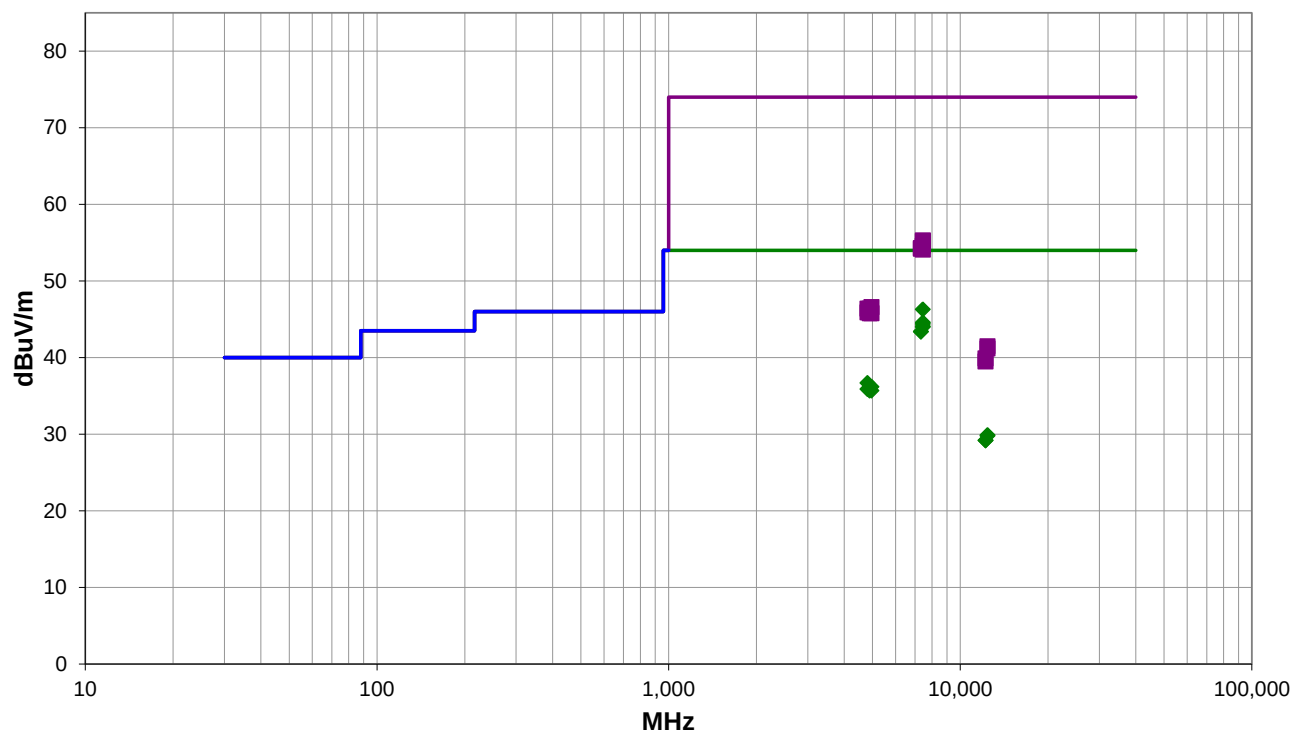
Please reference data comments below for: channel, data rate, and EUT orientation.

EUT OPERATING MODES

Continuous Tx, BLE, 125 kbps, Low Ch = 2402 MHz, Mid Ch = 2442 MHz, High Ch = 2480 MHz

DEVIATIONS FROM TEST STANDARD

None



Run #: 17

■ PK ◆ AV ● QP

SPURIOUS RADIATED EMISSIONS

RESULTS - Run #17

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
7438.083	28.3	15.6	1.5	356.0	2.4	0.0	Horz	AV	0.0	46.3	54.0	-7.7	High Ch 2 Mbps EUT Vert
7442.042	28.3	15.6	1.5	356.0	0.7	0.0	Horz	AV	0.0	44.6	54.0	-9.4	High Ch 1 Mbps EUT Vert
7437.625	28.4	15.6	1.5	356.0	0.4	0.0	Horz	AV	0.0	44.4	54.0	-9.6	High Ch 500 kbps EUT Vert
7437.533	28.4	15.6	1.5	161.0	0.1	0.0	Horz	AV	0.0	44.1	54.0	-9.9	High Ch 125 kbps EUT Vert
7440.583	28.3	15.6	1.5	327.0	0.1	0.0	Vert	AV	0.0	44.0	54.0	-10.0	High Ch 125 kbps EUT Horiz
7326.325	27.9	15.4	1.5	202.0	0.1	0.0	Vert	AV	0.0	43.4	54.0	-10.6	Mid Ch 125 kbps EUT Horiz
7327.292	27.9	15.4	1.5	157.0	0.1	0.0	Horz	AV	0.0	43.4	54.0	-10.6	Mid Ch 125 kbps EUT Vert
4803.775	28.9	7.7	2.3	50.0	0.1	0.0	Vert	AV	0.0	36.7	54.0	-17.3	Low Ch 125 kbps EUT Horiz
4960.058	28.4	7.7	1.5	151.0	0.1	0.0	Horz	AV	0.0	36.2	54.0	-17.8	High Ch 125 kbps EUT Vert
4884.050	28.1	7.7	1.0	360.0	0.1	0.0	Horz	AV	0.0	35.9	54.0	-18.1	Mid Ch 125 kbps EUT Vert
4803.608	28.1	7.7	2.2	43.0	0.1	0.0	Horz	AV	0.0	35.9	54.0	-18.1	Low Ch 125 kbps EUT Vert
4959.325	27.9	7.7	1.5	0.0	0.1	0.0	Vert	AV	0.0	35.7	54.0	-18.3	High Ch 125 kbps EUT Horiz
4884.292	27.9	7.7	1.5	53.0	0.1	0.0	Vert	AV	0.0	35.7	54.0	-18.3	Mid Ch 125 kbps EUT Horiz
7438.575	39.7	15.6	1.5	327.0	0.0	0.0	Vert	PK	0.0	55.3	74.0	-18.7	High Ch 125 kbps EUT Horiz
7442.350	39.6	15.6	1.5	356.0	0.0	0.0	Horz	PK	0.0	55.2	74.0	-18.8	High Ch 1 Mbps EUT Vert
7437.692	39.0	15.6	1.5	356.0	0.0	0.0	Horz	PK	0.0	54.6	74.0	-19.4	High Ch 500 kbps EUT Vert
7439.108	39.0	15.6	1.5	356.0	0.0	0.0	Horz	PK	0.0	54.6	74.0	-19.4	High Ch 2 Mbps EUT Vert
7325.567	38.9	15.4	1.5	157.0	0.0	0.0	Horz	PK	0.0	54.3	74.0	-19.7	Mid Ch 125 kbps EUT Vert
7325.425	38.8	15.4	1.5	202.0	0.0	0.0	Vert	PK	0.0	54.2	74.0	-19.8	Mid Ch 125 kbps EUT Horiz
7441.658	38.5	15.6	1.5	161.0	0.0	0.0	Horz	PK	0.0	54.1	74.0	-19.9	High Ch 125 kbps EUT Vert
12398.610	29.7	0.1	1.5	191.0	0.1	0.0	Horz	AV	0.0	29.9	54.0	-24.1	High Ch 125 kbps EUT Vert
12399.160	29.6	0.1	1.0	360.0	0.1	0.0	Vert	AV	0.0	29.8	54.0	-24.2	High Ch 125 kbps EUT Horiz
12208.410	29.6	-0.5	1.5	304.0	0.1	0.0	Vert	AV	0.0	29.2	54.0	-24.8	Mid Ch 125 kbps EUT Horiz
12209.350	29.6	-0.5	1.5	49.0	0.1	0.0	Horz	AV	0.0	29.2	54.0	-24.8	Mid Ch 125 kbps EUT Vert
4959.617	38.9	7.7	1.5	151.0	0.0	0.0	Horz	PK	0.0	46.6	74.0	-27.4	High Ch 125 kbps EUT Vert
4881.883	38.7	7.7	1.5	53.0	0.0	0.0	Vert	PK	0.0	46.4	74.0	-27.6	Mid Ch 125 kbps EUT Horiz
4806.200	38.7	7.7	2.2	43.0	0.0	0.0	Horz	PK	0.0	46.4	74.0	-27.6	Low Ch 125 kbps EUT Vert
4803.183	38.2	7.7	2.3	50.0	0.0	0.0	Vert	PK	0.0	45.9	74.0	-28.1	Low Ch 125 kbps EUT Horiz
4961.417	38.1	7.7	1.5	0.0	0.0	0.0	Vert	PK	0.0	45.8	74.0	-28.2	High Ch 125 kbps EUT Horiz
4885.967	38.1	7.7	1.0	360.0	0.0	0.0	Horz	PK	0.0	45.8	74.0	-28.2	Mid Ch 125 kbps EUT Vert
12398.600	41.4	0.1	1.5	191.0	0.0	0.0	Horz	PK	0.0	41.5	74.0	-32.5	High Ch 125 kbps EUT Vert
12397.730	41.1	0.1	1.0	360.0	0.0	0.0	Vert	PK	0.0	41.2	74.0	-32.8	High Ch 125 kbps EUT Horiz
12209.030	40.4	-0.5	1.5	49.0	0.0	0.0	Horz	PK	0.0	39.9	74.0	-34.1	Mid Ch 125 kbps EUT Vert
12210.020	40.0	-0.5	1.5	304.0	0.0	0.0	Vert	PK	0.0	39.5	74.0	-34.5	Mid Ch 125 kbps EUT Horiz

CONCLUSION

Pass



Tested By

SPURIOUS RADIATED EMISSIONS

EUT:	BluKey Plus™ S (BK+S)	Work Order:	PAYR0024
Serial Number:	B	Date:	2023-10-06
Customer:	PayRange Inc.	Temperature:	22.3°C
Attendees:	Mike Mitchell	Relative Humidity:	48.6%
Customer Project:	None	Bar. Pressure (PMSL):	1018 mb
Tested By:	Jeff Alcock and Chris Ladwig	Job Site:	EV01
Power:	12 VDC via 110VAC/60Hz	Configuration:	PAYR0024-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 3:2023	ANSI C63.10:2013
RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	24	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)
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COMMENTS

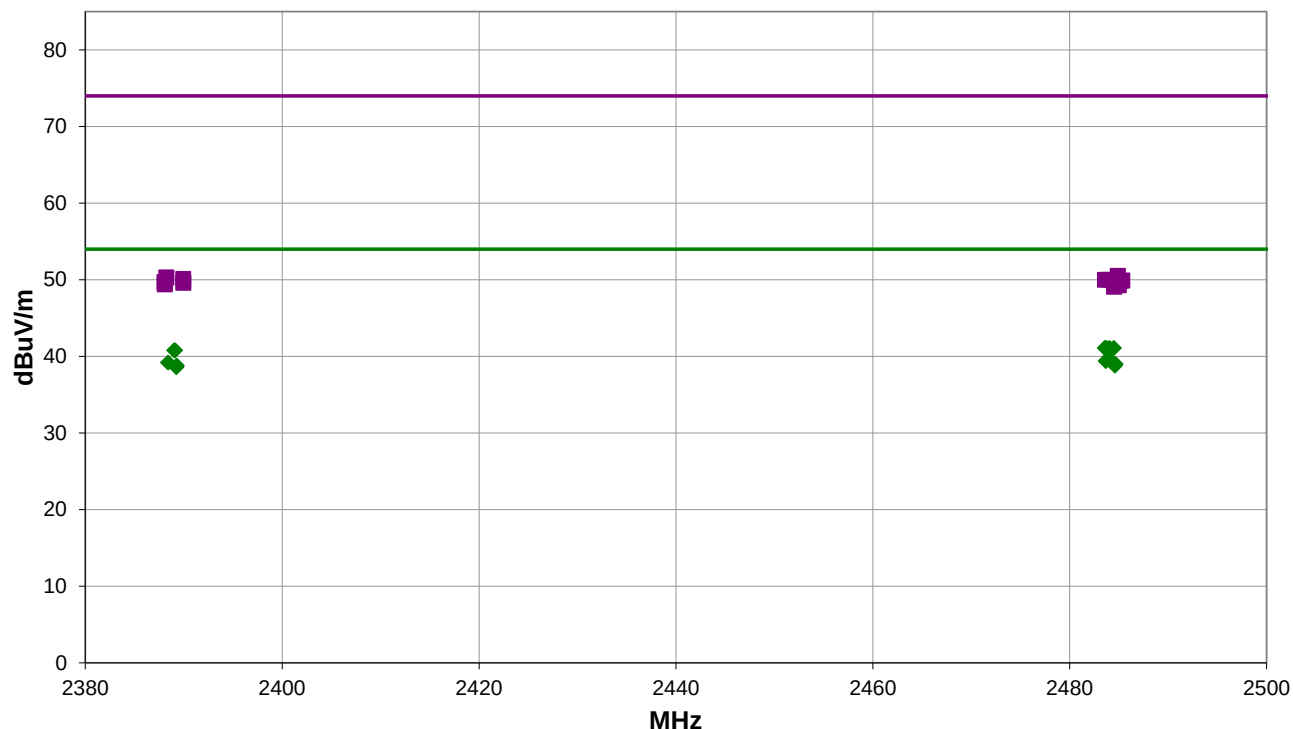
Please reference data comments below for: channel, data rate, and EUT orientation.

EUT OPERATING MODES

Continuous Tx, BLE, 125 kbps, Low Ch = 2402 MHz, Mid Ch = 2442 MHz, High Ch = 2480 MHz

DEVIATIONS FROM TEST STANDARD

None



Run #: 24

■ PK ◆ AV ● QP

SPURIOUS RADIATED EMISSIONS

RESULTS - Run #24

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2484.480	31.0	-2.3	1.5	325.0	2.4	10.0	Vert	AV	0.0	41.1	54.0	-12.9	High Ch 2 Mbps EUT Horiz
2483.700	31.0	-2.3	1.5	128.0	2.4	10.0	Horz	AV	0.0	41.1	54.0	-12.9	High Ch 2 Mbps EUT Vert
2483.570	31.0	-2.3	1.5	76.0	2.4	10.0	Vert	AV	0.0	41.1	54.0	-12.9	High Ch 2 Mbps EUT Vert
2484.023	31.0	-2.3	1.5	70.0	2.4	10.0	Vert	AV	0.0	41.1	54.0	-12.9	High Ch 2 Mbps EUT On Side
2484.100	30.9	-2.3	1.5	162.0	2.4	10.0	Horz	AV	0.0	41.0	54.0	-13.0	High Ch 2 Mbps EUT Horiz
2483.697	30.9	-2.3	1.5	307.0	2.4	10.0	Horz	AV	0.0	41.0	54.0	-13.0	High Ch 2 Mbps EUT On Side
2389.110	31.0	-2.6	1.5	336.0	2.4	10.0	Horz	AV	0.0	40.8	54.0	-13.2	Low Ch 2 Mbps EUT Vert
2389.030	31.0	-2.6	1.5	336.0	2.4	10.0	Vert	AV	0.0	40.8	54.0	-13.2	Low Ch 2 Mbps EUT Horiz
2484.070	31.1	-2.3	1.5	16.0	0.7	10.0	Horz	AV	0.0	39.5	54.0	-14.5	High Ch 1 Mbps EUT Vert
2483.663	31.0	-2.3	1.5	342.0	0.7	10.0	Vert	AV	0.0	39.4	54.0	-14.6	High Ch 1 Mbps EUT Horiz
2388.400	31.1	-2.6	1.5	336.0	0.7	10.0	Vert	AV	0.0	39.2	54.0	-14.8	Low Ch 1 Mbps EUT Horiz
2484.477	31.0	-2.3	1.5	5.0	0.4	10.0	Vert	AV	0.0	39.1	54.0	-14.9	High Ch 500 kbps EUT Horiz
2484.660	30.9	-2.3	1.5	5.0	0.4	10.0	Horz	AV	0.0	39.0	54.0	-15.0	High Ch 500 kbps EUT Vert
2484.590	31.0	-2.3	1.5	5.0	0.1	10.0	Horz	AV	0.0	38.8	54.0	-15.2	High Ch 125 kbps EUT Vert
2389.283	31.0	-2.6	1.5	336.0	0.4	10.0	Vert	AV	0.0	38.8	54.0	-15.2	Low Ch 500 kbps EUT Horiz
2389.240	31.1	-2.6	1.5	336.0	0.1	10.0	Vert	AV	0.0	38.6	54.0	-15.4	Low Ch 125 kbps EUT Horiz
2484.893	42.8	-2.3	1.5	5.0	0.0	10.0	Horz	PK	0.0	50.5	74.0	-23.5	High Ch 500 kbps EUT Vert
2388.233	42.9	-2.6	1.5	336.0	0.0	10.0	Vert	PK	0.0	50.3	74.0	-23.7	Low Ch 2 Mbps EUT Horiz
2389.940	42.7	-2.6	1.5	336.0	0.0	10.0	Horz	PK	0.0	50.1	74.0	-23.9	Low Ch 2 Mbps EUT Vert
2483.593	42.3	-2.3	1.5	70.0	0.0	10.0	Vert	PK	0.0	50.0	74.0	-24.0	High Ch 2 Mbps EUT On Side
2484.023	42.3	-2.3	1.5	5.0	0.0	10.0	Vert	PK	0.0	50.0	74.0	-24.0	High Ch 500 kbps EUT Horiz
2485.350	42.2	-2.3	1.5	162.0	0.0	10.0	Horz	PK	0.0	49.9	74.0	-24.1	High Ch 2 Mbps EUT Horiz
2485.073	42.1	-2.3	1.5	325.0	0.0	10.0	Vert	PK	0.0	49.8	74.0	-24.2	High Ch 2 Mbps EUT Horiz
2484.947	42.1	-2.3	1.5	307.0	0.0	10.0	Horz	PK	0.0	49.8	74.0	-24.2	High Ch 2 Mbps EUT On Side
2484.993	42.1	-2.3	1.5	16.0	0.0	10.0	Horz	PK	0.0	49.8	74.0	-24.2	High Ch 1 Mbps EUT Vert
2388.043	42.3	-2.6	1.5	336.0	0.0	10.0	Vert	PK	0.0	49.7	74.0	-24.3	Low Ch 1 Mbps EUT Horiz
2484.953	41.9	-2.3	1.5	76.0	0.0	10.0	Vert	PK	0.0	49.6	74.0	-24.4	High Ch 2 Mbps EUT Vert
2389.947	42.2	-2.6	1.5	336.0	0.0	10.0	Vert	PK	0.0	49.6	74.0	-24.4	Low Ch 125 kbps EUT Horiz
2388.070	42.0	-2.6	1.5	336.0	0.0	10.0	Vert	PK	0.0	49.4	74.0	-24.6	Low Ch 500 kbps EUT Horiz
2484.980	41.6	-2.3	1.5	5.0	0.0	10.0	Horz	PK	0.0	49.3	74.0	-24.7	High Ch 125 kbps EUT Vert
2484.533	41.5	-2.3	1.5	342.0	0.0	10.0	Vert	PK	0.0	49.2	74.0	-24.8	High Ch 1 Mbps EUT Horiz
2484.510	41.4	-2.3	1.5	128.0	0.0	10.0	Horz	PK	0.0	49.1	74.0	-24.9	High Ch 2 Mbps EUT Vert

CONCLUSION

Pass



Tested By

SPURIOUS RADIATED EMISSIONS

EUT:	BluKey Plus™ SD (BK+SD)	Work Order:	PAYR0024
Serial Number:	G	Date:	2023-10-06
Customer:	PayRange Inc.	Temperature:	22.6°C
Attendees:	Mike Mitchell	Relative Humidity:	48.8%
Customer Project:	None	Bar. Pressure (PMSL):	1016 mb
Tested By:	Jeff Alcock and Chris Ladwig	Job Site:	EV01
Power:	12 VDC via 110VAC/60Hz	Configuration:	PAYR0024-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 3:2023	ANSI C63.10:2013
RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	26	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)
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COMMENTS

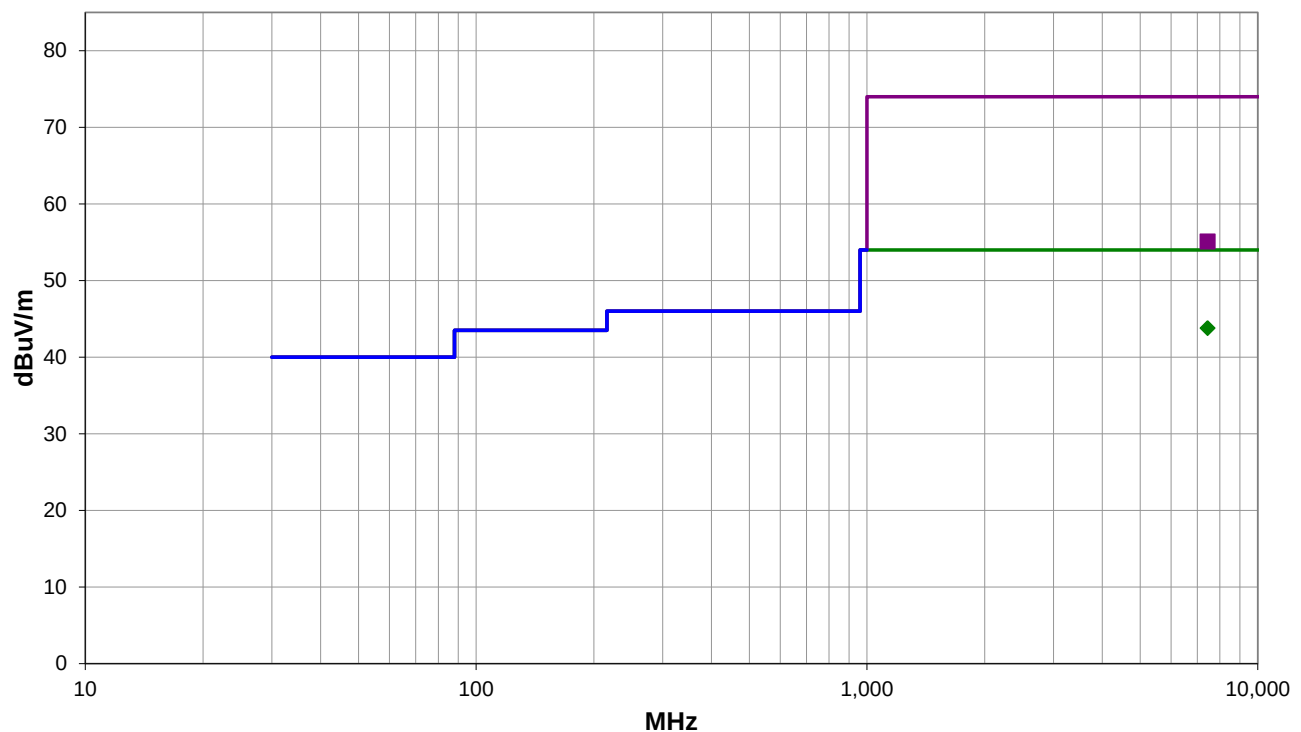
Please reference data comments below for: channel, data rate, and EUT orientation.
Spot check performed on worst case harmonic as determined from testing on Blukey++

EUT OPERATING MODES

Continuous Tx, BLE, 125 kbps, Low Ch = 2402 MHz, Mid Ch = 2442 MHz, High Ch = 2480 MHz

DEVIATIONS FROM TEST STANDARD

None



Run #: 26

PK AV QP

SPURIOUS RADIATED EMISSIONS

RESULTS - Run #26

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
7439.377	28.1	15.6	1.5	163.0	0.1	0.0	Horz	AV	0.0	43.8	54.0	-10.2	High Ch 125 kbps EUT Vert
7439.583	39.5	15.6	1.5	163.0	0.0	0.0	Horz	PK	0.0	55.1	74.0	-18.9	High Ch 125 kbps EUT Vert

CONCLUSION

Pass



Tested By

SPURIOUS RADIATED EMISSIONS

EUT:	BluKey Plus™ SD (BK+SD)	Work Order:	PAYR0024
Serial Number:	G	Date:	2023-10-06
Customer:	PayRange Inc.	Temperature:	22.6°C
Attendees:	Mike Mitchell	Relative Humidity:	48.8%
Customer Project:	None	Bar. Pressure (PMSL):	1016 mb
Tested By:	Jeff Alcock and Chris Ladwig	Job Site:	EV01
Power:	12 VDC via 110VAC/60Hz	Configuration:	PAYR0024-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 3:2023	ANSI C63.10:2013
RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	27	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)
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COMMENTS

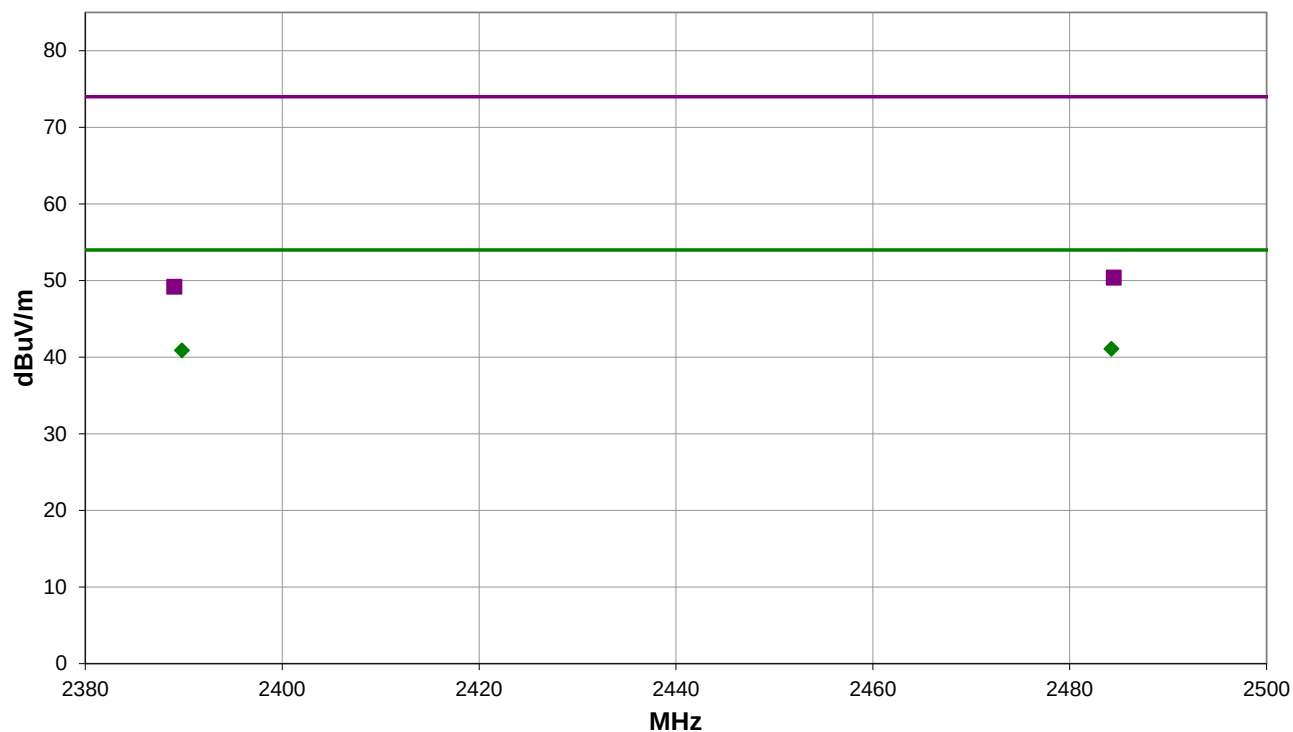
Please reference data comments below for: channel, data rate, and EUT orientation.
Spot checking performed on worst case data rate as determined from BluKey++ testing.

EUT OPERATING MODES

Continuous Tx, BLE, 125 kbps, Low Ch = 2402 MHz, Mid Ch = 2442 MHz, High Ch = 2480 MHz

DEVIATIONS FROM TEST STANDARD

None



Run #: 27

PK AV QP

SPURIOUS RADIATED EMISSIONS

RESULTS - Run #27

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2484.237	31.0	-2.3	2.9	123.0	2.4	10.0	Horz	AV	0.0	41.1	54.0	-12.9	High Ch 2 Mbps EUT Vert
2389.810	31.1	-2.6	3.8	282.0	2.4	10.0	Horz	AV	0.0	40.9	54.0	-13.1	Low Ch 2 Mbps EUT Vert
2484.470	42.7	-2.3	2.9	123.0	0.0	10.0	Horz	PK	0.0	50.4	74.0	-23.6	High Ch 2 Mbps EUT Vert
2389.030	41.8	-2.6	3.8	282.0	0.0	10.0	Horz	PK	0.0	49.2	74.0	-24.8	Low Ch 2 Mbps EUT Vert

CONCLUSION

Pass



Tested By

End of Test Report