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EMC testing of the Tektelic Communication Inc. COMFORT in accordance with FCC Part 15.247 and ANSI C63.10: 2013 as referenced by FCC OET KDB 558074 D01 15.247 Meas Guidance v05r02.

FCC ID: 2ALEPT0006338

Test Dates: 2025-03-07 to 2025-03-10

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REVISION RECORD

ISSUE	DATE	AUTHOR	REVISIONS
DRAFT 1	2025-03-18	I. Akram	Initial draft submitted for review.
DRAFT2	2025-04-04	I. Akram	Added Serial# and model# in Section 1.3.
Release 1	2025-04-07	I. Akram	Sign Off

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1.0 INTRODUCTION

1.1 Scope

The purpose of this report is to present the results of compliance testing performed in accordance with FCC part 15 subpart C, and ANSI C63.10-2013 to gain FCC Class II Authorization for Low-Power License-Exempt transmitters.

Tektelic Communications Inc. has two device variants referred to as COMFORT and VIVID. However, only the one COMFORT variant was tested for this report.

All test procedures, limits, criteria, and results described in this report apply solely to the tested variant of the COMFORT test sample, referred to herein as the EUT (Equipment Under Test).

The samples have been provided by the customer and were in good condition at the time of testing.

This report does not imply product endorsement by the Electronics Test Centre, A2LA, nor any Canadian Government agency.

The table below provides details on the two devices

1.2 Applicant

This test report has been prepared for Tektelic Communication Inc., located in Calgary, Alberta, Canada.

1.3 Test Sample Description

As provided to ETC (Airdrie) by Tektelic Communication Inc.:

Product Name:	COMFORT
Radio	LoRa
Frequency Band	902 – 928 MHz
Frequency Range	903 – 914.2 MHz
Operating Mode	500KHz DTS
Max Transmit Power (Conducted)	14.17 dBm (0.0261216 W)
Associated Antennas	RUN mXTENDTM (NN02-224) linearly polarized, Peak Gain = 2.2 dBi , Efficiency > 85%
Model#	T0009125
Serial#	2505T0103, 2505T0101
Power supply:	Internal Battery

Note: Out of two device variants, COMFORT and VIVID, only the COMFORT model was selected to perform radiated spurious emission analysis as it contain the option of external sensor connected via cable. All three channels (LOW, MID, High) on each axis (X, Y & Z) are analyzed to determine the worse channel. Full emission scan is performed on worse channel at worse axis for each radio. Detail given in Family exhibit.

Variant Name	PCBA T-code	Module T-Code
COMFORT	T0008998	T0009125
VIVID	T0008999	T0009126

1.4 General Test Conditions

The EUT was set up and exercised using the configurations, modes of operation and arrangements defined in this report only. All inputs and outputs to and from other equipment associated with the EUT were adequately simulated. In order to meet the operational requirements during testing as per KDB 558074 D01 15.247 Meas Guidance v05r02 and ANSI

C63.10-2013 clause 5.11 the device was programmed with a special firmware to transmit at a continuous transmit mode (100% duty cycle). Special firmware is strictly for testing purpose only and not available to end user. This special test case represents the worst-case duty cycle. For antenna port conducted emission SMA connector is soldered to the circuit board at the output of the radio to provide direct access to the radio output to connect spectrum analyzer. During testing EUT is powered via external DC power supply.

The environmental conditions are recorded during each test, and are reported in the relevant sections of this document.

1.5 Reference Standards

Standards	Description
FCC, title 47 CFR § 15.247	Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725- 5850 MHz.
FCC, title 47 CFR § 15.207	Conducted limits for an intentional radiator that is designed to be connected to the public utility (AC) power line.
FCC, title 47 CFR § 15.107	Conducted limits for equipment that is designed to be connected to the public utility (AC) power line.
FCC, title 47 CFR § 15.209	Radiated emission limits; general requirements
FCC, title 47 CFR § 15.109	Radiated emission limits; from unintentional radiators digital devices.
ANSI C63.10-2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
ANSI C63.4-2014	American National Standard for Methods of Measurement of Radio – Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 KHz to 40 GHz
558074 D01 15.247 Meas Guidance v05r02	Guidance For Compliance Measurements On Digital Transmission System, Frequency Hopping Spread Spectrum System, And Hybrid System Devices Operating Under Section 15.247 Of The FCC Rules

1.6 Test Methodology

Test methods are specified in the Basic Standard as referenced and/or modified by the Product Standard in the part of Section 2 of this report associated with each particular test case. EUT is tested in RX mode to cover FCC part 15 Sub Part B (Digital Circuitry).

1.6.1 Variations in Test Methodology

Any variance in methodology or deviation from the reference Standard is documented in the part of Section 2 of this report associated with each particular Test Case.

1.6.2 Test Sample Verification, Configuration & Modifications

EUT setup, configuration, protocols for operation and monitoring of EUT functions, and any modifications performed in order to meet the requirements, are detailed in each Test Case of Section 2 of this report.

1.6.3 Uncertainty of Measurement:

The factors contributing to measurement uncertainty are identified and calculated in accordance with CISPR 16-4-2: 2011.

This uncertainty estimate represents an expended uncertainty expressed at approximately 95% confidence using a coverage factor of k = 2.

Test Method	Uncertainty
Radiated Emissions Level (9 KHz – 1 GHz)	±5.8 dB
Radiated Emissions Level (1 GHz – 18 GHz)	±4.9 dB
Uncertainty Conducted Power level	±0.5 dB

2.0 TEST CONCLUSION

STATEMENT OF COMPLIANCE

The customer equipment referred to in this report was found to comply with the requirements, as summarized below.

The EUT was subjected to the following tests. Compliance status is reported as **Compliant** or **Non-compliant**. **N/A** indicates the test was Not Applicable to the EUT.

The measurement uncertainty is not accounted for determination of the statement of compliance. The statement of compliance is based only on the measurement value recorded.

Note: Maintenance of compliance is the responsibility of the Manufacturer. Any modifications to the product should be assessed to determine their potential impact on the compliance status of the EUT with respect to the standards detailed in this test report.

The following table summarizes the tests performed in terms of the specification, class or performance criterion applied, and the EUT modification state.

Test Case	Test Type	Specification	Test Sample	Modifications	Config.	Result
2.1	Max Average Output Power	15.247(d)	COMFORT	none	see § 2.1	Compliant
2.2	Radiated Spurious Emission (Restricted Band)	15.205, 15.209 15.247(d)	COMFORT	none	see § 2.2	Compliant
2.3	EUT Position	ANSI C63.4	COMFORT	none	see § 2.3	Assessed
2.4	RF Exposure	15.247(i)	COMFORT	none	see § 2.4	Exempt

Refer to the test data for applicable test conditions.

2.1 Max Average Output Power

Test Lab: Electronics Test Centre, Airdrie

Test Personnel: Youssef Metwally, Imran Akram EUT: COMFORT

Standard: FCC PART 15.247

Basic Standard: ANSI C63.10: 2013 FCC OET KDB 558074

Date: 2025-03-10 (21.4°C, 14.2% RH)

EUT status: Compliant

Specification: FCC Part 15.247(b, 3)

Criteria (3) For systems using digital modulation in the 902-928 MHz bands: 1 Watt.

2.1.1 Test Guidance: ANSI C63.10-2013, Clause 11.9.2.2.2/ FCC OET KDB 558074

This measurement is performed at low, mid and high frequencies, with modulation.

The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation. The loss from the cable and the attenuator were added on the analyzer as gain offset setting there by allowing direct measurements, without the need for any further corrections.

Output Power Method AVGSA-1 For LoRa DTS						
Span	≥ 1.5 times the OBW					
RBW	$1 - 5$ % of the OBW, ≤ 1 MHz					
VBW	≥ 3 x RBW					
Number of Points in sweep	≥ 2 x Span / RBW					
Sweep time	Auto					
Detector	RMS (Power Averaging)					
Sweep trigger	Free Run (Duty Cycle ≥98%)					
Trace Average	100 traces in power Averaging (RMS)					
Power measured	Integrated the spectrum across the OBW of the signal using the S/A band power measurement function, with band limit set equal to the OBW band edge.					

2.1.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

2.1.3 Test Equipment

Testing was performed with the following equipment:

Equipment	Manufacturer	Model #	Asset #	Cal. Date	Cal. Due
EMI receiver	Agilent	N9038A (FW A.25.05)	6130	2024-08-15	2025-08-15
Temp/Humidity	Extech	42270	5871	2024-04-08	2025-04-08
Attenuator (DC to 26 GHz)	Mini-Circuits	BW-S10-2W263+	6932	2022-12-10	2025-12-10
Coaxial Cables (RF)	W.L. GORE	PGR01R01036	7024	2025-01-09	2026-01-09
DC Blocker (9 KHz - 27 GHz)	Centric RF	C0927 SMA	6987	2025-01-19	2026-01-19

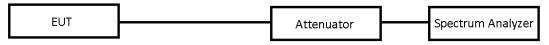
2.3.4 Test Sample Verification, Configuration & Modifications

The EUT was set to a selected channel with test-specific software. The output was modulated as in normal operation.

The EUT met the requirements without modification.

Test setup diagrams for Power testing:

Conducted:



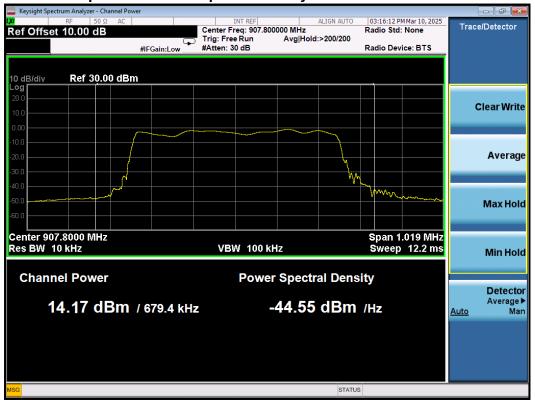
2.1.5 Max Average Output Power Data: LoRa DTS

Mode of operation	Channel	Freq. [MHz]	Max Average Power [dBm]	Limit Power [dBm]
	Low	903.0	14.10	
LoRa 500 KHz	Mid	907.8	14.17	≤ 30 (1Watt)
	High	914.2	13.92	

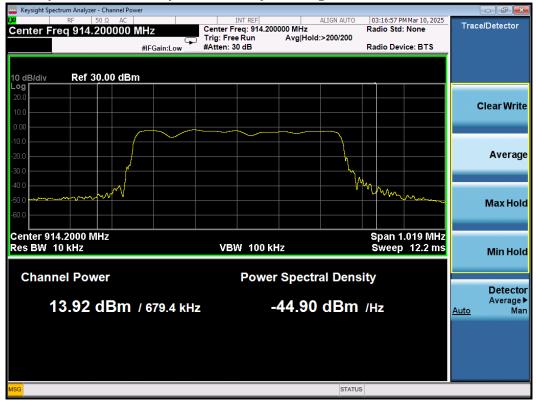


Screen Captures from the spectrum analyzer Low Channel

Screen Captures from the spectrum analyzer: MID Channel



Screen Captures from the spectrum analyzer: High Channel



2.2 Radiated Spurious Emissions (within restricted band)

Test Lab: Electronics Test Centre, Airdrie

Test Personnel: Youssef Metwally, Imran Akram Standard: FCC PART 15.247/15.209 Basic Standard: ANSI C63.10-2013

EUT: COMFORT

Date: 2025-03-(07,10) (22.0°C, 14.2% RH)

EUT status: Compliant

Specification: FCC PART 15.247(d)

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 below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

MHz	MHz	MHz	MHz	MHz	GHz	GHz
0.0900000 –	8.2910000 -	16.804250 -	162.01250 -	1660.0000 -	3.6000000 -	14.470000 -
0.1100000	8.2940000	16.804750	167.17000	1710.0000	4.4000000	14.500000
0.4950000 -	8.3620000 -	25.500000 -	167.72000 -	1718.8000 –	4.5000000 –	15.350000 -
0.5050000	8.3660000	25.670000	173.20000	1722.2000	5.1500000	16.200000
2.1735000 -	8.3762500 -	37.500000 -	240.00000 –	2200.0000 –	5.3500000 –	17.700000 –
2.1905000	8.3867500	38.250000	285.00000	2300.0000	5.4600000	21.400000
4.1250000 -	8.4142500 -	73.000000 -	322.00000 -	2310.0000 –	7.2500000 –	22.010000 –
4.1280000	8.4147500	74.600000	335.40000	2390.0000	7.7500000	23.120000
4.1772500 -	12.290000 -	74.800000 -	399.90000 -	2483.5000 –	8.0250000 -	23.600000 -
4.1777500	12.293000	75.200000	410.00000	2500.0000	8.5000000	24.000000
4.2072500 -	12.519750 -	108.00000 -	608.00000 -	2655.0000 -	9.0000000 –	31.200000 -
4.2077500	12.520250	121.94000 **	614.00000	2900.0000	9.2000000	31.800000
5.6770000 -	12.576750 -	123.00000 -	960.00000 –	32600000 –	9.3000000 -	36.430000 -
5.6830000	12.577250	138.00000 <mark>**</mark>	1240.0000 <mark>***</mark>	3267.0000	9.5000000	36.500000
6.2150000 -	13.360000 -	149.90000 -	1300.0000 –	3332.0000 –	10.600000 -	Above
6.2180000	13.410000	150.05000	1427.0000 <mark>***</mark>	3339.0000	12.700000	38.600000
6.2677500 -	16.420000 -	156.52475-	1435.0000 –	3345.8000 –	13.250000 –	
6.2682500	16.423000	156.52525	1626.5000	3358.0000	13.400000	
6.3117500 - 6.3122500	16.694750 - 16.695250	156.70000 - 156.90000	1645.5000 – 1646.5000	3500.0000 – 3600.0000		

Restricted Bands of Operation:

2.2.1 Test Guidance: ANSI C63.10-2013, Clause 13.4.2

From 9 kHz to 150 kHz (resolution bandwidth of 200 Hz) and from 150 kHz to 30 MHz (resolution bandwidth 9 kHz) measurements are performed with a loop antenna (as per KDB 460108).

From 30 MHz to 1000 MHz, measurements are performed with a broadband biconilog antenna and a resolution bandwidth of 120 kHz.

Above 1000 MHz, measurements are performed with a DRG Horn antenna or a Standard Gain horn, and a resolution bandwidth of 1 MHz The EUT is raised to 150 cm above the ground plane, and the area between the EUT and the antenna mast is covered with RF absorbent material.

The scan is performed at discreet increments of turntable azimuth and antenna height, which are selected in accordance with the applicable standard in order to assure capture of frequencies of interest. Optimization is performed based on the scan data.

Frequencies having peak emissions within 10dB of the limits are optimized. The EUT is rotated in azimuth over 360 degrees and the direction of maximum emission is noted.

Antenna height is varied from 1 - 4 meters at this azimuth to obtain the maximum emission. Then the maximum level is measured with the appropriate detector and recorded. Up to 1 GHz, measurements are performed with a Quasi-Peak detector. Above 1 GHz, measurements are recorded with Peak and/or Average detectors, as applicable.

2.2.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

2.2.3 Test Equipment

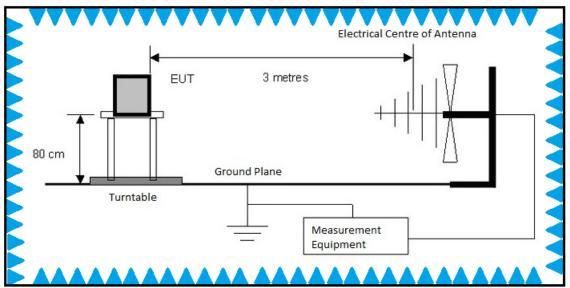
Testing was performed with the following equipment:

Equipment	Manufacturer	Model #	Asset #	Cal. Date (yyyy-mm-dd)	Cal. Due (yyyy-mm-dd)
EMC Software	UL	Ver. 9.5	SWC 021	N	/A
EMI receiver	Agilent	N9038A (FW A.25.05)	6130	2024-08-15	2025-08-15
Loop Antenna (9KHz – 30MHz)	EMCO	6502	10868	2023-06-21	2025-06-21
Biconilog Antenna (30 – 1000 MHz)	AR	JB1	6905	2023-11-29	2025-11-29
DRG Horn (1000 – 18000 MHz)	EMCO	3115	19357	2022-10-05	2025-10-05
Humidity/Temp Logger	Extech Ins. Corp.	42270	5892	2024-04-08	2025-04-08
Pre-Amplifier (30 – 1400 MHz)	HP	8447D	9291	2025-01-21	2026-01-21
Low Noise Amplifier (1 – 18 GHz)	MITEQ	JS43-01001800-21- 5P	4354	2025-01-21	2026-01-21
RE Cable below 1GHz	Insulated Wire Inc.	KPS-1501A-3600- KPA-01102006	4419	2025-01-21	2026-01-21
Re Cable Above 1 GHz	A.H. System Inc.	SAC-26G-8.23	6187	2025-01-21	2026-01-21
0.9GHz Notch Filter	Microtronics	BRM20784	6947	2025-01-21	2026-01-21

2.2.4 Test Sample Verification, Configuration & Modifications

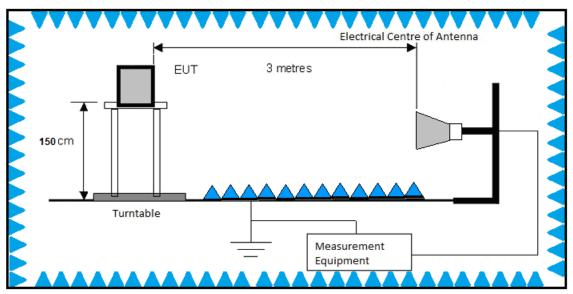
The EUT was set to a selected channel with test-specific software. The output was modulated as in normal operation. LoRa radio is transmitting at mid channel in ingle carrier configuration and high channel in dual carrier configurations.

The EUT met the requirements without modification.



Test setup diagram for Radiated Spurious Emissions testing (below 1GHz):

Test setup diagram for Radiated Spurious Emissions testing (above 1GHz):



2.2.5 Radiated Emissions Data: LoRa DTS

The emissions data are presented in tabular form, showing turntable azimuth, antenna height and polarization, the uncorrected spectrum analyzer reading, the correction factors applied, the net result, the value of the limit at the frequency investigated, and the Delta between the result and the limit.

Meter Reading in $dB_{\mu}V$ + Antenna Factor in dB/m + Gain/Loss Factor in dB = Corrected Field Strength in $db_{\mu}V/m$.

Delta = Field Strength – Limit

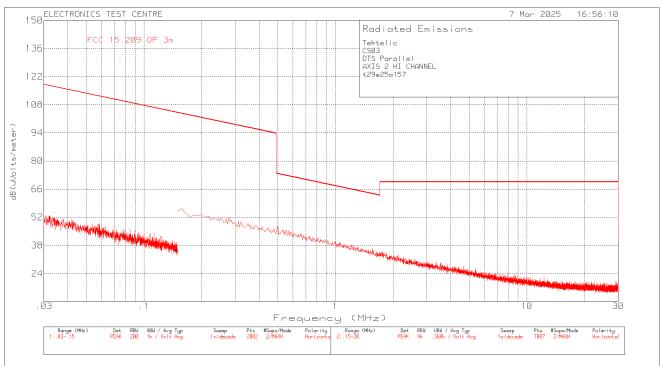
Notes:

- When a preamp is used, the resulting gain is compensated, producing a negative value for the Cable Loss.
- Measurements reported are the result of adjusting the turntable azimuth and antenna height to obtain the maximum EUT emission. This may produce a different reading than the plot trace. The plot is a Peak Hold function obtained at discreet increments of height and azimuth, while the reported measurement is obtained with the appropriate Quasi Peak or Average detector after the height and azimuth have been adjusted for maximum emission.
- Preliminary scans were performed for all channels in Transmit modes. The High band channel 914.2 MHz was selected as the worst-case condition for detailed examination.
- In Transmit mode, the EUT was assessed up to 10.0 GHz.

Freq. Marker	Freq. [GHz]	Raw reading[dBµv]	Det	Antenna Factor [dB/m]	Pre amp Gain [dB]	Corrected Reading [dBµv/m]	FCC 15.209 Limit [dBµv/m]	Delta [dB]	Azimuth [Deg]	Height [cm]	Polarization
1	5.65	23.4	AV	- 34	-29.6	27.8	54	-26.2	342	264	Horizontal
		35.89	РК			40.29	74	-33.72			
2	5.49	31.02	AV	34.1	-30.1	35.02	54	-18.98	239	276	Vertical
		42.79	PK			46.79	74	-27.21			

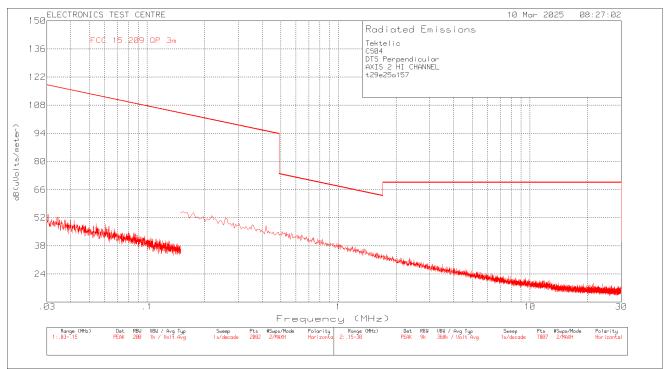
Negative values for Delta indicate compliance.

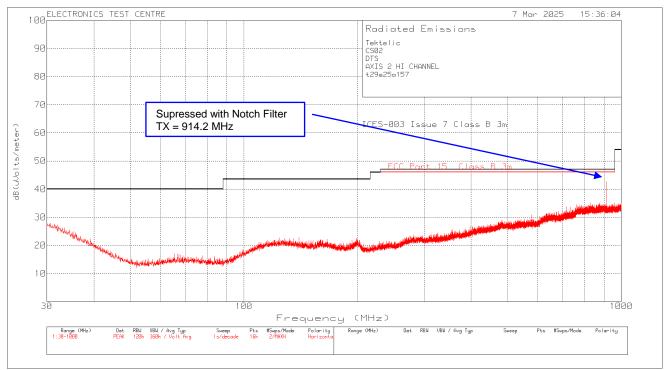
QP: Quasi-Peak Detector, PK: Peak Detector, AV: Average Detector * Spurious Emission in Restricted Band



Plot of Radiated Emissions: Parallel

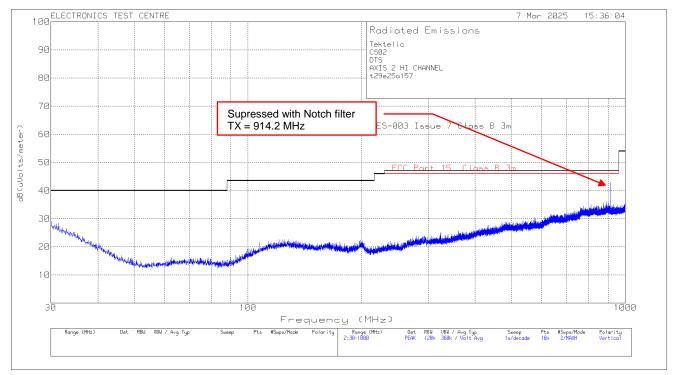
Plot of Radiated Emissions: Perpendicular

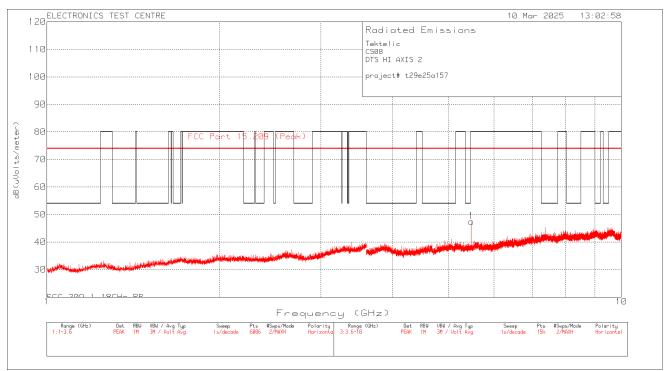




Plot of Radiated Emissions: Horizontal polarization

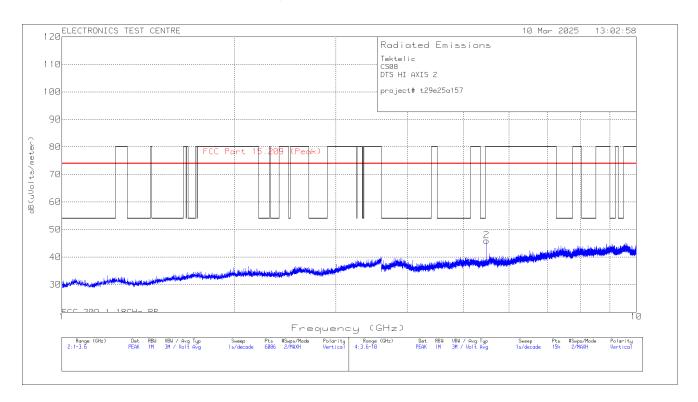
Plot of Radiated Emissions: Vertical polarization





Plot of Radiated Emissions: Horizontal polarization

Plot of Radiated Emissions: Vertical polarization



2.3 EUT Positioning Assessment

Test Lab: Electronics Test Centre, Airdrie

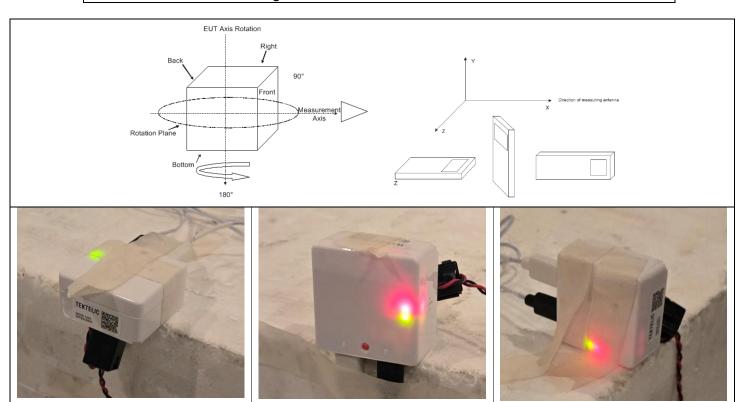
Test Personnel: Brendan Van Hee, Imran Akram EUT: COMFORT Standard: FCC PART 15.247 Basic Standard: ANSI C63.4-2014

Date: 2024-12-04 (20.1°C, 15.7% RH)

Comments: LoRa (500KHz) :Z-Axis

Specification: ANSI C63.4-2014, Clause 6.3.2.1

Portable, small, lightweight, or modular devices that may be handheld, worn on the body, or placed on a table during operation shall be positioned on a non-conducting platform, the top of which is 80 cm above the reference ground plane. The preferred area occupied by the EUT arrangement is 1 m by 1.5 m, but it may be larger or smaller to accommodate various sized EUTs (see Figure 6, Figure 7, and Figure 9). For testing purposes, ceiling- and wall-mounted devices also shall be positioned on a tabletop (see also 6.3.4 and 6.3.5). In making any tests involving handheld, body-worn, or ceiling-mounted equipment, it is essential to recognize that the measured levels may be dependent on the orientation (attitude) of the three orthogonal axes of the EUT. Thus, exploratory tests as specified in 8.3.1 shall be carried out for various axes orientations to determine the attitude having maximum or near-maximum emission level.



2.4 RF Exposure

Test Lab: Electronics Test Centre, Airdrie

Test Personnel:

EUT: COMFORT Standard: FCC PART 15.247

Date:

EUT status: Exempt from SAR Evaluation

Compliant: RF exposure assessment to be provided in a separate Exhibit.

3.0 TEST FACILITY

3.1 Location

The COMFORT was tested at the Electronics Test Centre laboratory located in Airdrie, Alberta, Canada. The Radio Frequency Anechoic Chamber (RFAC), identified as Chamber 1, has a usable working space measuring 10.6 m long x 7.3 m wide x 6.5 m high.

Measurements taken at this site are accepted by Industry Canada as evidence of conformity per registration file # 2046A. This site is also listed with the FCC under Registration Number CA2046.

The floor, walls and ceiling consist of annealed steel panels. The walls and ceiling are covered with ferrite tile, augmented by RF absorbant foam material on the end wall nearest the turntable, and on the adjacent walls and the ceiling. The chamber floor supports a 15 cm high internal floor, constructed of annealed steel panels, that forms the ground plane, and is bonded to the chamber walls.

The 3-m diameter turntable is flush-mounted with the floor. A sub-floor cable-way is provided to route cables between the turntable pit and EUT support equipment located in the Control Room. Cables reach the EUT through an opening in the centre of the turntable.

Test instrumentation and EUT support equipment is located in the Control Room, consisting of two shielded vestibules joined together at the side of the main room. Cables are routed through bulkhead panels between the rooms and the test chamber as required. Power feeds are routed into the main room and vestibules through line filters providing at least 100 dB of attenuation between 10 kHz and 10 GHz.

Either floor mounted or table-top equipment can be tested at this facility.

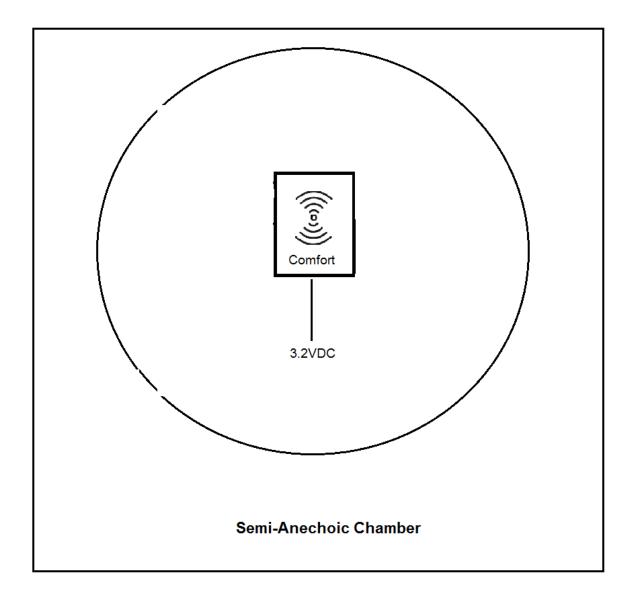
3.2 Grounding Plan

The COMFORT was placed at the center of the test chamber turntable on top of an 80cm high polystyrene foam table below 1GHz and at 1.5m high polystyrene foam table above 1 GHz for transmits mode. No provision is made within the COMFORT for an earth ground connection.

3.3 Power Supply

For radiated emission and antenna port average power measurement input power was supplied via external DC power supply.

Appendix A – Test Setup Block Diagram



End of Document