Low Power Devices

a General Overview of FCC and ETSI Standards

Presented by
International Approvals Laboratories

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Radio Terms & Definitions

- Low Power Device (LPD)
  - Device under 500mW ERP
- EIRP = Equivalent Isotropic Radiated Power
  - The arithmetic product of (a) the power supplied to an antenna and (b) its gain
  - Measured by spanning across the -6dB BW at a set RBW (power per RBW)
- Peak Power Density
  - The highest instantaneous level of power in Watts per Hertz generated by the transmitter within the power envelope
- ERP = Effective Radiated Power
  - The total power of the transmitter
- Occupied Bandwidth
  - 20dB Bandwidth / 99% Bandwidth
- Pass-band
  - 6dB bandwidth of emission
- Direct Sequence Spread Spectrum (DSSS)
  - Form of modulation where a combination of data to be transmitted and a fixed code sequence (chip sequence) is used to directly modulate a carrier, (e.g. by phase shift keying. The code sequence length depends of the occupied bandwidth

Radio Terms & Definitions

- Frequency Hopping Spread Spectrum (FHSS)
  - A spread spectrum technique in which the transmitter signal occupies a number of frequencies in time, each for some period of time, referred to as dwell time
- Radiated Measurement
  - Measurements which involve the absolute measurement of a radiated field
- Modulation
  - The process, or result of the process, of varying a characteristic of a carrier, in accordance with an information-bearing signal
- Gain
  - The ratio of output current, voltage, or power to input current, voltage, or power, respectively. Gain is usually expressed in dB. *Note 2:* If the ratio is less than unity, the gain, expressed in dB, will be negative, in which case there is a loss between input and output
- Spurious Emission
  - Any emission that falls outside the band in which a transmitter is meant to operate
- Duty Cycle (dc)
  - The time a transmitter is functionally transmitting in a specified period of time

Measuring Transmitting Power

- Radiated Measurement
  - An absolute measurement of field strength at a specified distance
- Calculating from Field Strength
  - The following formula may be used to convert field strength (FS) in volts/m to transmitter output power (TP) in watts:$TP= (FS*d)^2/(30*G)$ where D is the distance in meters between the two antennas and G is the antenna numerical gain referenced to isotropic gain
- Resistive Power Meter
  - A method utilized in cases where the antenna may be removed from the device or where an antenna port is available
  - The power meter must match the impedance of the rated antenna. If not, an impedance matching network may be used as long as the loss in the circuit is corrected in the measurement
- Signal Substitution
  - A method where a substitution antenna is driven by a source to match the measured maximum field at a given and set distance. The source power is then corrected as follows: ERP = S-CL+G where S is the source amplitude, CL is the cable loss and G is the antenna gain of the substitution antenna.

Duty Cycle Corrections

- Duty Cycle (dc)
  - The maximum time that the transmitter is operational an a 100mS period. (FCC/IC)
  - The maximum time that the transmitter is on in a 1-hour period. (ETSI/EU/ITU)
- Correcting for Duty Cycle
  - Only allowed in FCC/IC Standards
  - Instituted to expedite testing of LPD testing by allowing test to be completed in CW mode
  - Corrected by: DCCF = $20*\log_{10}(dc)$
  - A maximum of 20dB can be calculated in the final measurement

FCC vs. ETSI <30MHz

- 0.8m Measurement Height
- No product classes
- Extreme Conditions
  - 15.225 &15.227
- Variable Distances according to Frequency
- Absolute Field Measurement
- Measurement Distance
  - Depending on the frequency being measured

- 1.0m Measurement Height
- Extreme Conditions
- Product Classes
  - Requirements depend on product classes that consist of antenna type, frequency range and use
  - Requirements dependent on class
- Absolute Field Measurement
- Measurement Distance
  - 10m distance for carrier levels
  - Can use E-field-51.5dB instead of B-field
- Signal Substitution on Harmonics above 30MHz
- Standby Measurements are required

FCC vs. ETSI 25-1000MHz

- 0.8m Measurement Height
- Correction for Duty Cycle
- No Extreme Conditions
  - 15.231 Fc=40.66-40.70MHz
- Absolute Field Measurement
- Measurement Distance
  - 3m fixed

- 1.5m Measurement Height
- Extreme conditions
  - Voltage and Temperature
- Spurious Emissions
  - Completed in stand-by and operational
- ERP Measurement
  - Signal Substitution for carrier and spurious
- Adjacent channel limitations
  - Absolute Field Measurement
- Measurement Distance
  - 3-10m distance for carrier levels

FCC vs. ETSI SSD

- 0.8m Measurement Height
- Application is Dependent on DSSS and FHSS
- No Extreme Conditions
- Absolute Field Measurements
- Measurement Distance
  - 3m fixed

- 1.5m Measurement Height
- Application is Dependent on DSSS and FHSS
- Extreme conditions
  - Voltage and Temperature
- Spurious Emissions
  - Completed in operational
- ERP Measurement FHSS
  - Signal Substitution for carrier and spurious
- Peak Power Density Limits
- Adjacent channel limitations
  - Absolute Field Measurement
- Measurement Distance
  - 3-10m distance for carrier and spurious
  - May be closure for >1GHz

Submittals (FCC)

Rule Part 11, 15 & 18 Devices	*Other Rule Part Devices*	*Description*	*Comments*
2.1033(b)(1)	**2.1033(c)(1)**	*Manu. Contact*	See Page 1 of this report
2.1033(b)(2)	**2.1033(c)(2)**	*FCC Identifier*	
2.1033(b)(3)	**2.1033(c)(3)**	*Users Manual to include Operating, installation*	Attached as Exhibit
	2.1033(c)(4)	*Emissions Designator per 2.*	
	2.1033(c)(5)	*Frequency Range*	Not Applicable to Part 15 Devcies
	2.1033(c)(6)	*Power range and controls*	Not Applicable to Part 15 Devcies
	2.1033(c)(7)	*Maximum power ouput rating*	Not Applicable to Part 15 Devcies
	2.1033(c)(8)	*DC Voltage and Current suplying final RF stages*	Not Applicable to Part 15 Devcies
2.1033(b)(3)	**2.1033(c)(9)**	*Tune –up procedure*	Please refer to the users manual for applicability
2.1033(b)(4&5)	**2.1033(c)(10)**	*Complete Circuit Diagrams and circuit operation description*	Attached as Exhibit
2.1033(b)(7)	**2.1033(c)(11)**	*Photographs/drawings of the identification label & its location on the device*	Attached as Exhibit
2.1033(b)(7)	**2.1033(c)(12)**	*Photographs of the external and internal surfaces, and construction*	Attached as Exhibit

Submittals (FCC)

	2.1033(c)(13)	*Digital Modulation*	Not Applicable
2.1033(b)(6)	**2.1033(c)(14)**	*Report of Measurement* *Data Required by 2.1046 – 2.1057*	See Data Below (This report consists of the testing required under Part 15.231)
2.1033(b)(8)		*Description of publicly available support equipment used during test*	Refer to Exhibit B of this report (Client Test Plan)
2.1033(b)(9)		*Statement of Autorization to Part 15.37 of CFR47*	The equipment herein is being authorized in accordance to 15.37 of the CFR47 Rules.
2.1033(b)(10)		*Direct Sequence Spread Spectrum Devices (DSSS)*	Exhibit of compliance to 15.247(e)
2.1033(b)(10)		*Frequency Hopping Devices*	Exhibit of compliance to 15.247(a)(1)
2.1033(b)(11)		*Scanning receiver construction*	Exhibit stating compliance to construction in accordance to 15.121.
15.31	**15.31**	*Transmitter Supply Voltage*	Testing herein was completed in accordance to FCC CFR47 Part 15.31

Submittals (IC = FCC+ Following)

Information Required	*Description*	*Comments*
Modulation Type	(i.e. ASK, NON, FSK, DSSS, FHSS, etc.)	
Emissions Designator	Per TRC-49	
In Country Representative	Contact Information	
99% Bandwidth Measurement	Per RSS-210	

Submittals (EU)

- Application of the R&TTE Directive
  - Emissions, Immunity, Safety & Radio
- Place CE Marking and Class 2 Identifier on Product
- Notify EU Regulatory Agencies of Class 2 Devices/SRD's
  - The EU must be notified 30-days prior to shipment
- Notified Body Involvement is not Legislative
  - Letter of Opinion (where it is not clear what standard to apply)
  - Notified Body Backing (backing for compliance to ease the minds of the importer/installer)

IALabs… streamlining

- Product Information
  - New test plan and constructional data forms for clients with radio devices
- Test Plan
  - Complete test checklists with methods utilized in report templates
- Report Templates
  - Pre-generated report templates are being generated with separation pages for easy compilation.
  - All report templates will have all statements needed
- Report Compilation
  - Report compilation as the testing is completed, just PDF and insert after section separator
- Approval Submittals
  - Updating submittal folder structure to obtain information that is needed from our clients faster and more effectively
  - No longer carrying the burden of application fees by charging the client in advance